NATIONAL FRUIT AND CIDER INSTITUTE,

LONG ASHTON,

NEAR BRISTOL.

REPORT

FOR THE YEAR

1912.

BATH:

PRINTED BY WILLIAM LEWIS & SON, 12, NORTH GATE.

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The National Fruit and Cider Institute

LONG ASHTON, NEAR BRISTOL.

REPORT OF THE GOVERNORS

To the Tenth General Meeting of Governors, Members and Associates to be held in the Council Pavilion of the Bath and West and Southern Counties Society, Show Yard, Truro, on THURSDAY, MAY 29th, 1913.

Governors of the Institute :

ACLAND, Sir C. T. DYKE-, Bart., (Chairman)
BAKER, G. E. LLOYD-
BIFFEN, PROFESSOR R. H.
BULMER, H. P.
BUNYARD, G.
GIBBONS, H. H.
GRANT, W. J.
GRENVILLE, R. NEVILLE-
HOBHOUSE, RIGHT HONOURABLE H.
HUNT, A. E. BROOKE-
KEEL, W. W.
NAPIER, H. B.
OSBOURNE, J. S. SMYTH-
PRICE, A. T.
RILEY, JOHN
ROGERS, A. G. L.
SILLIFANT, A. O.
STRACHIE, THE RIGHT HON. LORD
TAYLOR, MONTAGU C. H.
WATTS, JAMES
WESTON, HENRY
WHEELER, E. VINCENT V.
WOLLASTON, G. H.
WOOTTON, JOHN H.

Managing Committee :

NAPIER, H. B. (Chairman)
GRENVILLE, R. NEVILLE-
OSBOURNE, J. S. SMYTH-
STRACHIE, THE RIGHT HON. LORD
WATTS, JAMES
WOOTTON, JOHN H.
(One Vacancy).

Members :

ACLAND, Sir C. T. D., Bart. Killerton, Exeter.
APPERLEY, H. W. Sandlin, Leigh Sinton, Malvern.
ARCHER, JAMES. 16, Charleville Circus, Sydenham.
BAKER, G. E. LLOYD-. Hardwicke Court, Gloucester.
BATTEN, H. CARY (Colonel). Leigh Lodge, Abbotsleigh, Bristol.
BATTEN, H. C. CARY. Ryme Intrinseca, Dorset.
BEAUCHAMP, THE RIGHT HON. THE EARL OF. Madresfield Court, Worcester.
BERKELEY HUNT AGRICULTURAL SOCIETY. Berkeley, Gloucester.
BOND, E. W. Hele, Cullompton, Devon.
BREWERS' EXHIBITION (ARTHUR T. DALE). 46, Cannon Street, London, E.C
BRISTOL & DISTRICT MARKET GARDENERS' ASSOCIATION. The Grove, Fishponds, Bristol.
BULMER, E. F. Ryelands, Hereford.
BULMER, H. P. Ryelands, Hereford.
BUNYARD, G. Royal Nurseries, Maidstone.
CALEY, A. J. & SON, Ltd. Norwich.
CHEVALLIER, J. B. Aspall Hall, Debenham, Suffolk.
CHILDS, CHRISTOPHER. Boscarn, Love, R.S.O., Cornwall.
CLIFFORD, THE RIGHT HON. LORD. Ugbrooke, Chudleigh, Devon
COUTTS, H. BURDETT MONEY. Stoodleigh Court, Tiverton.
CRAWSHAY, F. W. (Captain). Hempnall House, Hempnall, Norfolk.
CURRE, W. E. C. (Colonel). Itton Court, Chepstow.
DANKS, R. M. Charlton House, Hartlebury, Worcester.
DART, C. Broadhembury, Honiton, Devon.
DAUBUZ, J. C. Killiow, Truro, Cornwall.
DAVIS, HERBERT J. Sutton Montis, Sparkford, Somerset.
DOWDEN, J. MOSTYN. Messrs. Dowden & Pook, 41, Bermondsey Square, London.
DURHAM, H. E. (Dr.) Sunnyside, Broomy Hill, Hereford.

Members *(continued).*

ELLIS, HENRY ARTHUR. Highman, Gloucester.
EVANS, F. H. Littlehempston, Totnes, Devon.
FARWELL, E. W. 11, Laura Place, Bath.
FLETCHER, E. Hazeldine, Rydes Hill, near Guildford.
GARTON, J. W. Clarendon Park, Salisbury.
GIBBONS, H. H. Church Farm, Clutton, Bristol.
GIBBS, H. M. Barrow Court, Somerset.
GILBEY, Sir WALTER, Bart. Elsenham Hall, Essex
GOULTON, WM. 1A, Grove Park Road, South Tottenham, London, N.
GRANT, W. J. County Council Offices, Newport.
GRENVILLE, R. NEVILLE-. Butleigh Court, Glastonbury, Somerset.
GREW, JAMES. Co. Armagh Cider Co., Portadown, Ireland.
HANCOCK, H. C. The Court, Milverton, Taunton.
HART, ALEX. Knighton-on-Teme, Tenbury.
HAYDON, H. COURTENAY. Chettiscombe, Tiverton, Devon.
HENEAGE, G. W. Coker Court, Yeovil.
HINCKES, R. T. Foxley, Hereford.
HOBHOUSE, RT. HON. H. Hadspen House, Castle Cary, Somerset.
HURLE, J. COOKE. Brislington Hill, Brislington, Somerset.
JEFFREY, ROBERT. The Throsk, Succoth Place, Murrayfield.
KEEL, WALTER W. Stanton Drew, Bristol.
KELLY, A. L. (Major). Cadbury House, North Cadbury, Somerset.
LISTER, E. G. Westwood Manor, Bradford-on-Avon, Wilts.
MARSHALL, L. H. Chippenham, Wilts.
MID-SOMERSET AGRICULTURAL SOCIETY. Shepton Mallet.
MOLE, H. B. Royal Albert Brewery, Queen's Road, Reading.
MONMOUTHSHIRE CHAMBER OF AGRICULTURE. Newport.
NAPIER, H. B. Estate Office, Long Ashton, Bristol.
NORTH SOMERSET AGRICULTURAL SOCIETY (F. W. HUNT). 26, Nicholas St., Bristol.
OSBORN, C. Woolston, North Cadbury, Somerset.
OSBOURNE, J. S. SMYTH-. Ash, Iddesleigh, N. Devon.
PIGOTT, Mrs. AGNES SMYTH. Brockley Hall, Somerset.
PITT, WM. Southstoke House, near Bath.
POWER, THOMAS. Dungarvan, Waterford, Ireland.
PRICE, M. PHILIP. Tibberton Court, Gloucestershire.
RADSTOCK AND DISTRICT SMALL HOLDINGS SOCIETY, LTD. (Secretary, A. P. Grenfell, Wynbee Hall, 28, Commercial Street, Radstock, Somerset).
RANKIN, Sir JAMES, Bart., M.P. Bryngwyn, Hereford.
RILEY, JOHN. Putley Court, Ledbury.
ROGERS, A. G. L. Board of Agriculture and Fisheries. Craven House, Northumberland Avenue, London, W.C.
ROYAL JERSEY AGRICULTURAL SOCIETY. Jersey.
SHELLEY, Sir JOHN, Bart. Shobrooke Park, Crediton, Devon
SHERSTON, C. D. (Major). Evercreech, Bath.
SILLIFANT, A. O. Culm Leigh, Stoke Canon, Exeter.
SOMERSET COUNTY AGRICULTURAL ASSOCIATION. Taunton.
SOMERVILLE, A. F. Dinder, Wells, Somerset.
STEWART, J. FINLAY. Aish Cross House, near Totnes, Devon.
STIRLING, JAMES L. 18, Eustace Street, Dublin.
STOOKE, J. E. HELLYAR. 2, Palace Yard, Hereford.
STRACHIE, The RIGHT HON. LORD. Sutton Court, Pensford, Bristol.
SUTTON, LEONARD G. Hillside, Reading.
SYMONS, JOHN & Co., Ltd. Totnes, Devon.
THOMAS, AUBREY (Lieut.-Col.). Overross, Hereford.
TILLEY, L. H. Banham, near Attleborough, Norfolk.
TILLEY, W. T. S. East Compton, Shepton Mallet.
VANDELEUR, THOS. P. Par Station, Cornwall.

Members *(continued).*

WALLIS, W. Tewkesbury, Gloucester.
WARDLAW, H. Holway Farm, Sherborne, Dorset.
WARREN, RICHARD A. Belle Vue, Harrow Road, Worcester.
WATTS, JAMES. Backwell, near Bristol.
WHEELER, E. VINCENT V. Newnham Court, Tenbury, Worcestershire.
WHISH, E. BARCLAY. The Cottage, East Cranmore, Shepton Mallet.
WILLIAMS, T. W. Bank Chambers, Corn Street, Bristol.
WILSON & Co., LTD. Frome, Somerset.
WOLLASTON, G. H. Flax Bourton, Bristol.
WOOTTON, JOHN H. Byford, Hereford.
WRIGHT, H. STUART. The Grange, Long Ashton, Bristol.

Associates:

ADAMS, ROWLAND. The Rosery, Long Ashton.
ALLEN, J. D. Springfield, Shepton Mallet.
ALLISON, J. B. Rock Villa, Burrowbridge, Bridgwater.
ASHFORD, A. W. West End Farm, Chedzoy, Bridgwater.
BARTLETT, FELIX PAUL. Riviera, Brixham, Devon.
BATTEN, GEORGE. Rosebank, Pensford, Bristol.
BAX, ALFRED. Barrow Gurney, Somerset.
BELL, F. A. Wellow House, Wellow, Newark.
BIRD, WILLIAM. The Nest, Overndale Road, Fishponds, Bristol.
BLINMAN, H. T. Farrington Gurney, Somerset.
BRITTEN, J. E. Old Wood, Tenbury, Worcester.
BRITTON, ERNEST. Brook Farm, Bishopsworth, Somerset.
BROCK, A. J. Myrtle Cottage, Dundry, Somerset.
BROWN, ALEXANDER. Court Farm, Failand, near Bristol.
BUTLER, GEORGE H. Charlton Farm, Portbury, Somerset.
BUTLER, WILLIAM. Gatcombe Farm, Long Ashton.
CARPENTER, F. M. Whitecross Court, Whitchurch, Somerset.
CARTER, FREDERICK J. Failand Farm, Failand, Bristol.
CAZALET, R. H. The Bannut Tree House, Castlemorton, Malvern, Worcester.
CHAPMAN, WALTER. Hewish, Bristol.
CHILD, FREDERICK. Hazels Farm, Wraxall, Somerset.
CHOLMELEY, H. C. FAIRFAX. Brandsby, Easingwold, York.
CROFTS, JOHN. Sutton Montis, Sparkford, Somerset.
DAVIES, DAVID. Gable Farm, Wraxall, Somerset.
DAVIES, JAMES. Marden, near Hereford.
DAVIS, WILLIAM, Highbridge Farm, Dundry, Bristol.
DE GOOSH, ARTHUR W. Kimball Buildings, 18, Tremont Street, Boston, U.S.A.
ELEY, JOHN P. Mays Hill, Frampton Cotterell, near Bristol.
FOORD, JAMES. Brook Farm, Backwell, Somerset.
FOWLES, L. E. Wallwyn Court, Much Marcle, Hereford.
GILES, JOHN. Portbury, Bristol.
GRIPPER, H. P. Myrtle House, Bradpole, Bridport, Dorset.
HAM, CHARLES. 44, Mary Arches Street, Exeter.
HARDING, RICHMOND. Fenswood Farm, Long Ashton.
HOWLAND, A. T. Sunnybrook Fruit and Bee Farm, Beckford, near Tewkesbury.
HUNT, WALTER. Easton-in-Gordano, Somerset.
JONES, GEORGE. Wood Farm, Welland, Malvern.
KNIGHT, R. P. Bridge Farm, Whitchurch, Somerset.
LAMBERT, WM. Castle Hill, Brenchley, Kent.
LANGFORD, E. W. Wyebridge Stores, Hereford
McCREATH, W. D. Quantock Vale Cider Works, North Petherton, Bridgwater.
MISSEN, GEORGE. Shrubberts Farm, Backwall Common, Bristol.
PARSONS, GEORGE. Long Ashton, Somerset.
PATCH, CHARLES. "Fox and Goose," Barrow Gurney, Somerset.
PATCH, ERNEST PHILIP. Long Ashton, Somerset.

PEARCE, ALFRED JAMES. Reservoir Farm, Barrow Gurney, Somerset.
PEARCE, JOHN. Hilltop Farm, Barrow Gurney, Somerset.
PERHAM, WM. EDWARD. Flax Bourton Court, Bristol.
POPE, JOHN M. Spence Combe, Copplestone, Devon.
POWELL, J. J. S. Hall Court, Much Marcle, Hereford.
PROCTOR, MRS. Gatcombe Court, Gatcombe, Bristol.
PULLIN, JOHN W. Compton Greenfield, near Bristol.
REID, HUGH. Long Ashton, Bristol.
REYNOLDS, EDWIN. Redwood Farm, Barrow Gurney, Somerset.
RIDLER, R. E. Clehonger Manor, Hereford.
RILEY, W. A. 100, King Street, Norwich.
RIPLEY, E. G. Beaston House, Bucknall, Shropshire.
STONE, THOS. Wine and Cider Merchant, Axminster.
STUCKEY, JAMES. Whare Koa, Beaford, Devon.
SYMES, J. H. Coat Farm, Martock, Somerset.
TAVENER, GEORGE E. Budlake, Broadclyst, Devon.
TAYLOR, HENRY. Rudge Farm, Long Ashton, Bristol.
THOMPSON, ERNEST H. Gilmorton, Tenbury, Worcester.
TUCKETT, PHILIP D. Netherton, near Newton Abbott.
TUDWAY, C. C. Wells, Somerset.
TURNER, J. S. Dowland Barton, Dolton, Devon.
TURNER, WM. Heath Barton, Pinhoe, Exeter.
VESSEY, EDGAR C. 19, Cotham Grove, Bristol.
VICKERY GEORGE. 6, Portman Terrace, Cheddon Road, Taunton.
VOWLES, CHAS. ELLIOTT. School Farm, Barrow Gurney, Somerset.
VOWLES, ERNEST. Upper Mill, Barrow Gurney, Somerset.
WALKER, J. S. Fern Lodge, Beech Road, Weston-super-Mare.
WALKEY, C. E. J. Edgeborough, Staplegrove, Taunton.
WALL, JOHN. Crickham, Wedmore, Somerset.
WARREN, CYPRIAN A. 8, Lichfield Gardens, Richmond, Surrey.
WELLS, EDGAR H. Ford, Wellington, Somerset.
WESTON, HENRY. Bounds Farm, Much Marcle, Hereford.
WILSON, JAMES. Freeman's Farm, Barrow Gurney, Somerset.
WINDHAM, E. J. Bembridge, Isle of Wight.
WINSTONE, GEORGE. Castle Farm, Flax Bourton, Bristol.
WINTLE, A. 1, Tower Street, Temple, Bristol.
WITHERS, W. R. Lower Court Farm, Long Ashton.

Life Member :

HUNT, A. E. BROOKE-. 6, Augusta Gardens, Folkestone.

Hon. Members.

Secretary, Devon Agricultural Education Committee.
" Gloucester " " "
" Hereford " " "
" Somerset " " "
" Worcester " " "

BIFFEN, PROFESSOR R. H. The Gables, Histon, Cambridge.
LLOYD, F. J. Muscovy House, Trinity Square, London, E.C.
WALKER, E. G. F. The Hollies, Chewstoke, Bristol.

Resident Director :

Professor B. T. P. BARKER, M.A., Hon. F.R.H.S. The National Fruit and Cider Institute, Long Ashton, Bristol.

Hon. Adviser in Practical Horticulture :

J. ETTLE, F.R.H.S. Stanley Grove Road, Weston-super-Mare.

Hon. Treasurer :

H. B. NAPIER. Estate Office, Long Ashton, Bristol.

Hon. Secretary :

W. J. GRANT. County Council Offices, Pentonville, Newport, Mon.

REPORT BY THE GOVERNORS.

1. The Governors beg to submit to the Members the following Report on the work of the Institute during the past year.

2. The Institute has been founded and is maintained by the following Bodies :—

The Board of Agriculture and Fisheries.
The Bath and West and Southern Counties Society.
Devon County Council.
Gloucester County Council.
Hereford County Council.
Monmouth County Council.
Somerset County Council.
Worcester County Council.

3. Since the formation of the Institute, new Members and Associates have been enrolled each year, and the Governors hope that as the work and objects of the Institute become more widely known there will be a steady increase in the number of both Members and Associates. Members and Associates.

4. In accordance with Article 30 of the Articles of Association, the following Governors retire :—

Governors.	By whom appointed.
Davis, H. J.	Somerset County Council.
Gibbons, H. H.	Members and Associates.
Grenville, R. Neville-	Board of Agriculture.
Osbourne, J. S. Smyth-	Devon County Council.
Strachie, The Right Hon. Lord	Governors.
Riley, John	Governors.
Taylor, Montagu C. H.	Worcestershire County Council.
Preece, Thos.	Herefordshire County Council.
Watts, James	Members and Associates.

Messrs. H. Weston and W. W. Keel have been nominated in place of Messrs. Thos. Preece and H. J. Davis, while Mr. John Riley does not wish to continue as a Governor.

Messrs. R. Neville-Grenville, J. S. Smyth-Osbourne, and Montagu C. H. Taylor have again been re-nominated by the bodies they represent, while the Board of Agriculture and Fisheries have nominated Mr. A. G. L. Rogers as a Governor in place of Sir Thomas H. Elliott, K.C.B., who has resigned his position as Secretary to the Board.

Advantages of Institute.

5. The Governors and Managing Committee wish to impress upon the Counties concerned, and upon all persons interested in the important industry of Cider-making the advantages of the opportunity now placed at their disposal, through the formation of the Institute, by means of which they may obtain advice and assistance bearing upon this industry, either by personally visiting the Institute, or by sending their sons there to receive instruction, scientific and practical, not only in Cider and Perry-making, but also in the growth of fruit and the production of fruit trees.

Working Pupils.

6 Working pupils from subscribing Counties can be received at the Institute for a period of not less than one year for instruction upon Fruit-growing, and to work upon the Farm. Pupils receive a wage of 7s. 6d. per week from the Institute.

Distribution of Cider Apple and Perry Pear Trees.

7. Trees have again been distributed during this season (1912) for the purpose of establishing demonstration Cider and Perry Orchards.

Practical Work.

8. In October and November, 1912, the Cider-making months, a large number of those interested in the West country industry of Cider-making availed themselves of the opportunity of visiting the Institute.

Inspection of Institute, Fruit Nursery and Plantation.

9. Since the last Report the Institute has been inspected by those who are interested both in the Cider industry and Fruit Culture from many counties, all of whom seemed to be thoroughly impressed with the very practical and thorough manner in which the making of Cider was carried out, and also in the production of the best Cider Apples and Perry Pears, which are being grown in the Nursery attached to the Institute.

Object Lesson

10. With a view of extending the usefulness of the Institute arrangements were made by which exhibits of an educational character were sent to the following Shows:—

Bath and West and Southern Counties Society's, Bath.
Brewers' Exhibition, London.
Hereford and Worcester Agricultural Society's.
Mid-Somerset Agricultural Society's.
Gloucester Agricultural Society's.
Hereford County Council.
Monmouth County Council.

Devon County Agricultural Society's.
Bristol and District Agricultural Development Association.

11. A thoroughly representative, and certainly one of the largest, gatherings that has yet taken place at the Institute, met on Thursday, 1st May, 1913, for the purpose of inspecting the Fruit plantations, seeing the work that was being done, and tasting the Cider and Perry made from Fruit grown in the various Cider counties, after which short addresses on the value of the work done at the Institute were given by Sir Isambard Owen, D.C.L., LL.D., M.D. (Vice-Chancellor of the University of Bristol), Mr. A. G. L. Rogers (Head of the Horticultural branch of the Board of Agriculture and Fisheries), and Professor B. T. P. Barker, M.A. Annual Tasting Day.

12. The Governors take this opportunity of requesting all who are either interested in the Institute or in the work it is doing, to use their influence in urging others to become Members. Members' subscriptions are one guinea per annum, for which they receive all the literature published by the Institute, and can have either six varieties of Apples or Pears or six kinds of Cider or Perry analysed each year. They are also able to purchase Cider Apple and Perry Pear Trees raised at the Institute to the number of 100 per annum at the rate of 2s. per tree, (to Non-members the price is 2s. 6d. per tree), as far as the supply permits. Grafts and buds of apples and pears are also available. Associates' subscriptions are 5s. per annum. They have the same privileges, with the exception that they are unable to vote at the Annual Meeting. Both Members and Associates can visit the Institute and obtain advice from the Director and other members of the staff, upon all matters in connection with the Fruit-growing and Cider industries.

13. In the Appendix will be found a Report upon the work of the Institute during 1912 by the Director, Professor B. T. P. Barker, M.A.

W. J. Grant,
Hon. Sec.

THE NATIONAL FRUIT AND CIDER INSTITUTE.

CASH ACCOUNT FOR THE YEAR 1912.

To GRANTS—								
Board of Agriculture			£750	0	0			
Bath and West of England Society			100	0	0			
Devon County Council			100	0	0			
Gloucester County Council			100	0	0			
Hereford County Council (1911)			100	0	0			
Somerset County Council			100	0	0			
Worcester County Council			100	0	0			
Monmouth County Council			50	0	0			
						1400	0	0
To AFFILIATION FEES—								
Berkeley Hunt Agricultural Society			1	1	0			
Brewers' Exhibition			1	1	0			
Bristol University			1	1	0			
Bristol and District Market Gardeners' Association			1	1	0			
Mid-Somerset Agricultural Society			1	1	0			
Monmouth Chamber of Agriculture			1	1	0			
North Somerset Agricultural Society			1	1	0			
Royal Jersey Agricultural Society			1	1	0			
Somerset Agricultural Society			1	1	0			
						9	9	0
To MEMBERS' SUBSCRIPTIONS						79	0	0
To ASSOCIATES' SUBSCRIPTIONS						17	10	0
To SALES						270	7	7
To MISCELLANEOUS—								
Harding R., One Year's Grazing						9	10	0
						£1785	16	7

We certify that the above is a true extract from the Cash Book of the National Fruit and Cider Institute.

(Signed) CURTIS, JENKINS & CO.,
Chartered Accountants.

Bristol: 27th February, 1913.

By Balance due to Bank							£83	2 9
By SCIENTIFIC STAFF AND EXPENSES—								
Barker B. T. P.			£325	0	0			
Camps W.			100	0	0			
Eves J. W.			32	13	1			
Sundry Bills and Expenses			31	2	8			
						488	15	9
By RENTS, RATES, etc.—								
Ashton Court Estate			80	0	0			
Rates, Taxes and Insurance			20	14	8			
						100	14	8
By BUILDINGS ACCOUNT—ADDITIONS								
Machinery, Plant, etc. ,,			42	8	4			
Laboratory Fittings ,,			3	5	3			
						45	13	7
By MANAGEMENT ACCOUNT—								
Auditors, Accountant, Correspondents			65	5	6			
Secretarial Postages and Expenses			7	13	5			
Treasurer's Postages			5	4	3			
Printing, Stationery, etc.			37	0	3			
						115	3	5
By ORCHARDS, NURSERY & PLANTATIONS—								
Labour			367	6	5			
Trees, Manure, etc.			87	18	5			
Superintendent's Honorarium and Expenses			62	6	7			
						517	11	5
By CIDER MAKING—								
Labour			173	8	3			
Apples, Carriage, etc.			199	5	3			
						372	13	6
By MISCELLANEOUS ACCOUNT—								
Show Expenses and Sundries						62	1	6
						£1785	16	7

Balance Sheet, 31st December, 1912.

Liabilities.	£	s.	d.	*Assets.*	£	s.	d.	£	s.	d.
Revenue Account Balance	809	3	9	PROPERTY ACCOUNT—						
				Buildings	13	19	3			
				Machinery, Plant, etc.	125	2	2			
				Laboratory fittings	30	18	7			
								170	0	0
				STOCKS—						
				Nursery	448	14	6			
				Cider	157	17	3			
								606	11	9
				Sundry Debtors, as per Ledger				32	12	0
	£809	3	9					£809	3	9

(Signed) G. E. LLOYD BAKER,
JAMES WATTS, } Governors.

Auditors' Report.—We report that we have audited the Books and Accounts of the Institute for the year ended 31st December, 1912. together with the Balance Sheet made up as on that day and above set forth. All the information and explanations required have been furnished us. In our opinion the Balance Sheet above referred to is properly drawn up so as to exhibit a true and correct view of the state of the Institute's affairs according to the best of the information and explanations supplied to us, and as shown by the books of the Institute.

Bristol; 27th February, 1913.

(Signed) CURTIS, JENKINS & CO.,
Chartered Accountants.

APPENDIX.

THE ASSOCIATION OF THE INSTITUTE WITH THE UNIVERSITY OF BRISTOL.

In the Annual Report of the Institute for 1911 it was stated that there might be a considerable extension of its work in the near future. This expectation has been realised, and the outstanding event of the Institute's year has been the accomplishment of its association with the University of Bristol. It will be recalled that the Board of Agriculture had intimated that it was prepared to make a substantial grant from the fund placed at its disposal by the Development Commissioners for purposes of agricultural research, provided that the Institute became associated with the University of Bristol, and that certain other conditions were complied with. A sum of £33,000 per annum has been granted by the Commissioners to the Board from the Development Fund to enable it to provide for research in various branches of agriculture. The scheme now being organised by the Board is to establish throughout the country about a dozen Research Stations, each of which is to be allotted a special subject for investigation. There will, for example, be one station engaged upon the study of soils, another concerned with problems of animal nutrition, and a third with plant-breeding. The subjects selected cover practically the whole range of agriculture. As far as possible existing institutions are being made use of under the scheme in connection with the subject with which they are already particularly identified. The Board, therefore, being anxious to locate one of these stations in the West of England and to stimulate through it the development of agriculture in that area, have selected the Institute as the centre for investigations in fruit culture and the practical treatment of plant diseases. In pursuance of its policy that, where practicable, each research station should be linked to a university, so that the institutions might acquire a university standing and gain the benefit of the close association of their staffs with those of other university departments, the Board laid down as a condition for the allocation of this work to Long Ashton that the Institute should associate itself with the University of Bristol. The establishment of a new department in the University was thus necessitated, the work of which was to be centred at Long Ashton. The University was invited to submit a scheme for the establishment of such a department, and after negotiation with the Governing Body of

the Institute arrived at a mutually satisfactory scheme, which has been submitted to the Board and has received its approval.

The details of the scheme, as set out in the Ordinance to associate the Institute with the University, are as follows. The Institute places the entire management of the research station at Long Ashton in the hands of a committee of sixteen members (now known as the Agricultural Research Committee), seven of whom are the members of the Managing Committee of the Institute and five, (the Vice-Chancellor being one), appointed by the Council of the University, four by the Senate of the University, and one by the Board of Agriculture. The Agricultural Research Committee has full control of the income of the Institute and is entitled to use for the objects of the Institute the said income, and also the lands, houses, furniture, or movable property, trees, plants, or live stock, for the time being belonging to the Institute, or assigned to its use by the University or by any other person or persons. This Committee has appointed a sub-Committee, consisting of the present members of the Managing Committee of the Institute, for the purposes of so much of its work as concerns fruit-growing and the manufacture of cider and perry. All officers and employees of the Institute continue to hold as nearly as possible the same offices or employment as heretofore under the same conditions and tenure. The objects of the Institute continue to be those specified in its Memorandum of Association, and the Articles of Association remain in force and continue to govern the business of the Institute as far as is consistent with the provisions of the Ordinance of Association. All grants made to the University for agricultural or horticultural research are, unless otherwise indicated in the terms of the grant, to be placed at the disposal of the Agricultural Research Committee to be dealt with under the provisions of the Ordinance.

This association of the Institute with the University has, as already stated, involved the establishment of a new department in the University, to which the title of Department of Agricultural and Horticultural Research has been given. The Director of the Institute has been appointed head of the Department and Professor of Agricultural Biology in the University. As far as possible the work of the Department will be carried on at the Institute, which thus becomes the Agricultural and Horticultural Research Station of the University.

The Board of Agriculture at the same time intimated to the University that it was prepared to make it one of the Advisory Centres for the provision of technical advice to farmers, and that it desired that this scheme should be associated with the research

scheme just outlined. The Board has been granted from the Development Fund by the Commissioners an annual sum of £12,000 for the provision of advice and assistance to farmers in connection with the various local problems in agriculture with which they have to contend. For the organisation of this work the counties throughout the country are being divided up into twelve groups, and an Advisory Centre is being established in connection with each. The Bristol centre will serve the counties of Gloucester, Hereford, Somerset, Wiltshire and Worcester; and it is anticipated that Devon and Monmouth, both of which contribute annual grants to the Institute, will also be associated for questions relating to fruit culture and cider-making. The organisation of the work of the Bristol centre will be in the hands of the Agricultural Research Committee referred to above; and the Department of Agricultural and Horticultural Research will be responsible for it in addition to the research work in connection with fruit culture.

In order to carry on these two schemes considerable developments at Long Ashton have been made necessary. The staff has been increased by the appointments of Mr. A. H. Lees, M.A., who will act as Plant Pathologist and deal with diseases of plants; Mr. C. T. Gimingham, F.I.C., as Agricultural Chemist, to undertake soil investigations and other problems of a chemical nature; Mr. Grove, as Oenologist, to devote special attention to fermentation problems; Mr. J. W. Eves, as Pomologist, to take charge of the practical experiments in fruit culture; and Mr. W. Camps, as Laboratory Assistant. The two former gentlemen have been specially appointed in connection with the Advisory scheme. A mycologist is to be appointed later. Mr. John Ettle, F.R.H.S, has been granted permission by the Somerset County Council to act as Adviser in Practical Horticulture to the Department. Mr. E. P. West has been appointed Manager-Secretary of the Station.

The primitive laboratory accommodation at the Institute is obviously inadequate, and arrangements have accordingly been made for the erection of new laboratories. Several additional buildings are also required in connection with the schemes, including an extension of the cider house, a manager's house, greenhouses, a fruit room, and other horticultural buildings. It has been estimated that a sum of about £10,000 will be necessary to cover the cost of the buildings and their equipment in addition to the purchase of the existing buildings and ten and a half acres of land immediately adjoining, which will be required for the new buildings and other purposes. One half of this sum has been promised by the Treasury, provided that the other half could be raised locally. The Chairman

of the Agricultural Research Committee, the Right Hon. Henry Hobhouse, undertook to endeavour to raise that amount; and the successful accomplishment of that object is mainly due to his invaluable assistance. The plans of the new buildings have now been approved by the Development Commissioners, and the erection is being proceeded with. The purchase of the land has already been completed. It is probable that at least fifty acres of land will be required for the full development of the work of the station. At present the Institute has about seventeen and a half acres already planted for its fruit work, including the ten and a half acres now the property of the Department, the remainder being held on lease from the Ashton Court Estate. This area will suffice for immediate purposes, and additional land as required will be leased from time to time.

The annual expenditure necessary to carry on the work of the institution when the two schemes are in full working order has been estimated to approach £5,500. The present income of the Institute averages from £1,200 to £1,500. To this in future will be added a sum of £300, the interest on a grant of money made by the late Lord Winterstoke to the University for agricultural work. The Board of Agriculture is prepared to make an annual grant not exceeding £2,500 towards the Research Scheme, provided that the local contributions do not fall below one-half of that sum. In addition it will make a separate grant of £1,000 to cover the expenses of the Advisory Scheme. The probable income from all sources will thus just suffice to meet the estimated expenditure. At the same time it is clearly most necessary that the present grants from County Councils to the Institute should be maintained, since any deficiency in that direction will be followed by the reduction of the research grant of the Board by twice that sum. The members of the Agricultural Research Committee, the body which will in future hold the general responsibility for the work of the institution, are the Right Hon. Henry Hobhouse (Chairman), Sir Isambard Owen, D.C.L., LL.D., M.D., (Vice-Chancellor of the University), Sir C. T. Dyke Acland, Bart., Mr. Hiatt C. Baker, and Professor Ainsworth Davis, M.A. (Principal of the Royal Agricultural College, Cirencester), representing the Council of the University; Professors F. Francis, D.Sc., Ph.D., F.I.C., and Lloyd Morgan, D.Sc., LL.D., F.R.S., and Drs. O. V. Darbishire, B.A., and W. D. Henderson, M.A., B.Sc., representing the Senate of the University; and the seven members of the present Managing Committee of the Institute. The representative of the Board of Agriculture has not yet been appointed.

The Institute has thus now entered upon a new phase in its

career, and it may be regarded as having passed beyond the probationary stage to that of a permanent institution. The provisions of the agreement with the University of Bristol have been drawn up so as to ensure that the work for which it was originally established shall not suffer in any way by the change. It stands in fact to gain immeasurably by the altered conditions, and its continuity is now assured.

The present opportunity may be taken to acknowledge its indebtedness to the Bath and West Society and other bodies for the financial and other support rendered during the critical period which has elapsed since its establishment, when its existence depended practically entirely upon that support; and the hope may be expressed that it may be further continued to enable the institution to carry on under more favourable circumstances the work which it is expected to do in aiding the interests of agriculture in the West of England and in providing for the farmers in that area the advantage of facilities for advice and assistance in no way inferior to those in other parts of the country.

SINGLE VARIETY TRIALS OF CIDER AND PERRY FRUIT.

In view of the exceptionally sunny and dry character of the summer of 1911 a special degree of interest attached to the trials of vintage varieties conducted in the ciderhouse on similar lines to those which have been carried on each season since the establishment of the Institute.

The following summary deals briefly with the characters and the leading features of interest of the ciders made from the individual varieties named :—

CIDERS.

SHARP VARIETIES—(including those containing normally at least ·45 per cent. Malic Acid).

New Foxwhelp (Marden, Hereford).—Analysis of fresh juice, October 6th, 1911 : specific gravity 1·059, malic acid ·74 per cent., tannin ·210 per cent. Weight of fruit, 304lbs. ; yield of juice, 236lbs. Average daily fall in specific gravity at 28°C., ·0043. Filtered October 30th, 1911 : specific gravity 1·019, Specific gravity in bottle, May 2nd, 1912 : 1·011. A thin, decidedly acid. somewhat dry cider of moderate body. Aroma well marked, but not altogether pleasant : flavour fair with an appreciable musty character. Moderately useful for blending, but decidedly inferior this season to most of the other sharp varieties.

Neverblight (North Cadbury, Somerset).—Analysis of fresh juice, December 14th, 1911 : specific gravity 1·058, malic acid ·36 per cent., tannin ·284 per cent. Weight of fruit, 1,040lbs. ; yield of juice, 802lbs. Average daily fall in specific gravity at 28° C., ·0096. Filtered January 1st, 1912 : specific gravity 1·026. Specific gravity in bottle, May 2nd, 1912 : 1·020. A pleasant medium cider of fair body and hardly appreciable acidity. Aroma and flavour well developed and good. Very palatable as a light cider for use alone, and also useful for blending. Somewhat lacking in richness as compared with the majority of this season's ciders.

Bull's Eye (Marden, Hereford).—Analysis of fresh juice, November 7th, 1911 : specific gravity 1·055, malic acid ·79 per cent., tannin ·084 per cent. Weight of fruit, 769lbs. ; yield of juice, 610lbs. Average daily fall in specific gravity at 28°C., ·0110. Filtered November 20th, 1911 : specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912 : 1·020. A medium sweet, rather sharp cider, with inferior aroma, but of fair flavour. Fairly useful for blending, but not of striking merit.

Wallis's White (Tewkesbury, Glos.).—Analysis of fresh juice, November 1st, 1911 : specific gravity 1·042, malic acid ·58 per cent., tannin ·060 per cent. Weight of fruit, 1,074lbs. ; yield of juice, 870lbs. Average daily fall in specific gravity at 28°C., ·0041. Filtered November 15th, 1911 : specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912 : 1·022. A very thin, rather acid cider ; aroma very slight and not pleasing, flavour inferior. An inferior medium sharp cider for blending, possessing little merit.

Brice's Kernel (Tewkesbury, Glos.).—Analysis of fresh juice, November 1st, 1911 : specific gravity 1·047, malic acid ·75 per cent., tannin ·134 per cent. Weight

of fruit, 1,038lbs. : yield of juice, 814lbs. Average daily fall in specific gravity at 28°C., ·0030. Filtered November 14th, 1911 : specific gravity 1·033. Specific gravity in bottle, May 2nd, 1912 : 1·024. A medium sweet, rather sharp cider of very fair character, although lacking somewhat in body ; aroma fairly well marked and pleasant, and flavour very fair. A useful, medium quality cider for blending.

South Queening (Marden, Hereford).—Analysis of fresh juice, October 25th, 1911 : specific gravity 1·047, malic acid ·62 per cent., tannin ·176 per cent. Weight of fruit, 1,104lbs.; yield of juice, 856lbs. Average daily fall in specific gravity at 28°C., ·0082. Filtered November 6th, 1911 : specific gravity 1·034. Specific gravity in bottle, May 2nd, 1912 : 1·025. A medium sweet, slightly acid cider, lacking in body and possessing inferior aroma and flavour. Moderately useful for blending, but of second rate quality only.

Sam's Crab (Marden, Hereford).—Analysis of fresh juice, October 17th, 1911 : specific gravity 1·063, malic acid ·53 per cent., tannin ·152 per cent. Weight of fruit, 895lbs. : yield of juice, 775lbs. Average daily fall in specific gravity at 28°C., ·0021. Filtered November 1st, 1911 : specific gravity 1·031. Specific gravity in bottle, May 2nd, 1912 : 1·027. A very useful, medium sweet and brisk cider, possessing well-marked and pleasant aroma and of good flavour. The tannin is comparatively prominent in the flavour. A very pleasant light cider of fair body for use alone and excellent when blended with a cider of heavier type.

Dufflin (Truro, Cornwall).—Analysis of fresh juice, October 24th, 1911 : specific gravity 1·065, malic acid ·90 per cent., tannin ·186 per cent. Weight of fruit, 1,288lbs. ; yield of juice, 1,006lbs. Average daily fall in specific gravity at 28°C., ·0025. Filtered January 4th, 1912 : specific gravity 1·033. Specific gravity in bottle, May 2nd, 1912 : 1.030. A rich, sweet, decidedly acid, full-bodied cider ; aroma and flavour good. Too sharp for use alone, but very useful for blending.

Frederick A. (Monmouth).—Analysis of fresh juice, November 9th, 1911 : specific gravity 1·062, malic acid ·95 per cent., tannin ·094 per cent. Weight of fruit, 1,980lbs. ; yield of juice 1,520lbs. Average daily fall in specific gravity at 28°C., ·0022. Filtered December 18th, 1911 : specific gravity 1·036. Specific gravity in bottle, May 2nd, 1912 : 1·031. A sharp cider of fair body ; flavour and aroma characteristic of the variety. Too sharp for use alone, but gives good results when suitably blended.

Ditto B. (Monmouth).—Made from the same lot of juice as the preceding, the difference in treatment being that in this case the juice was filtered direct from the press before fermentation. Filtered again December 20th, 1911 : specific gravity 1·046. Specific gravity in bottle, May 2nd, 1912 : 1·043. A cider almost identical in character with the preceding, the only material difference being that of sweetness. The filtration direct from the press had the effect of delaying the onset of fermentation two to three weeks, and hence, when filtered at approximately the same date as the preceding, fermentation had not proceeded so far and there was more residual sugar.

Backwell Red (Backwell, Somerset).—Analysis of fresh juice, November 1st, 1911 : specific gravity 1·056, malic acid ·72 per cent., tannin ·140 per cent. Weight of fruit, 1,094lbs. ; yield of juice, 872lbs. Average daily fall in specific gravity at 28°C., ·0042. Filtered November 15th, 1911 : specific gravity 1·040. Specific gravity in bottle, May 2nd, 1912 : 1·035. A rich brisk cider of good body ; aroma well marked and pleasant, flavour good. Slightly too brisk for use alone, but gives excellent results on blending with small quantities of sweet or bitter-sweet ciders.

Porter's Perfection (East Lambrook, Somerset).—Analysis of fresh juice, December 20th, 1911: specific gravity 1·048, malic acid ·42 per cent., tannin ·312 per cent. Weight of fruit, 1,218lbs.; yield of juice, 974lbs. Average daily fall in specific gravity at 28°C., ·0037. Filtered January 19th, 1912: specific gravity 1·037. Specific gravity in bottle, May 2nd, 1912: 1·036. A sweet, brisk cider of excellent quality and very low alcoholic strength; body full, aroma slight but pleasant, flavour good. A good cider unblended.

Cherry Pearmain (Marden, Hereford).—Analysis of fresh juice, November 10th, 1911: specific gravity 1·068, malic acid ·64 per cent., tannin ·174 per cent. Weight of fruit, 345lbs.; yield of juice, 261lbs. Average daily fall in specific gravity at 28°C., ·0038. Filtered December 15th, 1911: specific gravity 1·040. Specific gravity in bottle, May 2nd, 1912: 1·038. A rich, medium brisk cider of full body and fruity character; aroma fairly well developed and pleasant, flavour good. A very useful cider alone.

Yellow Styre (Tewkesbury, Glos.).—Analysis of fresh juice, October 25th, 1911: specific gravity 1·066, malic acid ·73 per cent., tannin ·114 per cent. Weight of fruit, 1,138lbs.; yield of juice, 848lbs. Average daily fall in specific gravity at 28°C., ·0025. Filtered January 2nd, 1912: specific gravity 1·042. Specific gravity in bottle, May 2nd, 1912: 1·038. A rich, slightly acid cider of excellent quality; aroma well marked and fruity, flavour clean and pleasant. Full-bodied and well adapted for use alone, although improved by blending.

Butterbox (Bickington, Devon).—Analysis of fresh juice, November 15th, 1911: specific gravity 1·055, malic acid ·62 per cent., tannin ·158 per cent. Weight of fruit, 1,024lbs.; yield of juice, 818lbs. Average daily fall in specific gravity at 28°C., ·0046. Filtered December 23rd, 1911: specific gravity 1·039. Specific gravity in bottle, May 2nd, 1912: 1·039. A full-bodied, sweet, and moderately brisk cider; aroma inferior, and flavour rather insipid and lacking in distinction. Useful for blending, but possessing too little character alone.

Cap of Liberty (East Lambrook, Somerset).—Analysis of fresh juice, November 23rd, 1911: specific gravity 1·069, malic acid ·85 per cent., tannin ·302 per cent. Weight of fruit, 947lbs.; yield of juice, 677lbs. Average daily fall in specific gravity at 28°C., ·0045. Filtered January 15th, 1912: specific gravity 1·040. Specific gravity in bottle, May 2nd, 1912: 1·037. A good sharp, full-bodied, rich cider; aroma well-marked and pleasant, flavour good. Too sharp for use alone, but excellent for blending.

Cap of Liberty (Martock, Somerset).—Analysis of fresh juice, November 23rd, 1911: specific gravity 1·072, malic acid ·82 per cent., tannin ·326 per cent. Weight of fruit, 1,194lbs.; yield of juice, 905lbs. Average daily fall in specific gravity at 28°C., ·0039. Filtered January 23rd, 1912: specific gravity 1·045. Specific gravity in bottle, May 2nd, 1912: 1·042. A very rich, acid cider of excellent quality and body; aroma pronounced and fruity, flavour clean and very good. Too sharp for use alone, but a valuable full-bodied cider for blending.

Kingston Black (Hereford).—Analysis of fresh juice, October 25th, 1912: specific gravity 1·054, malic acid ·69 per cent., tannin ·164 per cent. Weight of fruit, 1,120lbs.; yield of juice, 832lbs. Average daily fall in specific gravity at 28°C., ·0035. Filtered November 13th, 1911: specific gravity 1·035. Specific gravity in bottle, May 2nd, 1912: 1·022. A medium sweet, brisk cider of moderate body and quality; aroma good, flavour fair. Does not approach the usual standard for this variety, but nevertheless a fair cider for use alone.

Ditto (Ilminster, Somerset).—Analysis of fresh juice, November 29th, 1911 : specific gravity of juice 1·076, malic acid ·59 per cent., tannin ·272 per cent. Weight of fruit, 1,165lbs. ; yield of juice, 903lbs. Average daily fall in specific gravity at 28°C., ·0045. Filtered January 15th, 1912 : specific gravity 1·038. Specific gravity in bottle, May 2nd, 1912 : 1·037. A rich, medium brisk cider of full body and good flavour and aroma. With the exception of a slight harshness in flavour, common this year to all the ciders of this variety, an excellent cider unblended.

Ditto (Staplegrove, Somerset).—Analysis of fresh juice, November 14th, 1911 : specific gravity 1·076, malic acid ·58 per cent., tannin ·272 per cent. Weight of fruit, 1,118lbs. ; yield of juice, 833lbs. Average daily fall in specific gravity at 28°C., ·0045. Filtered December 22nd, 1911 : specific gravity 1·043. Specific gravity in bottle, May 2nd, 1912 : 1·037. A sweet, moderately brisk full-bodied cider of very fair aroma and flavour. Astringency rather marked, otherwise good unblended.

Ditto (Staplegrove, Somerset).—Analysis of fresh juice, December 20th, 1911 : specific gravity 1·088, malic acid ·59 per cent., tannin ·484 per cent. Weight of fruit, 440lbs. ; yield of juice, 271lbs. Average daily fall in specific gravity at 28°C., ·0046. The liquor practically ceased to ferment and cleared naturally when the specific gravity reached 1·055 approximately. It was therefore never filtered. Specific gravity in bottle, May 2nd, 1912 : 1·052. A very sweet, rich cider of medium briskness and very full body ; aroma and flavour good, although showing evidence that the fruit had been kept too long before milling. This sample was made from fruit from the same source as the preceding cider, but was stored five weeks longer before milling.

Ditto (Martock, Somerset).—Analysis of fresh juice, November 28th, 1911 : gravity 1·067, malic acid ·46 per cent., tannin ·228 per cent. Weight of fruit, 1,260lbs. ; yield of juice, 966lbs. Average daily fall in specific gravity at 28° C., ·0030. Filtered January 18th, 1912 : specific gravity 1·040. Specific gravity in bottle, May 2nd, 1912 : 1·038. An excellent full-bodied sweet cider of medium briskness ; aroma and flavour well-marked and characteristic of the variety.

Ditto (Tewkesbury, Glos.)—Analysis of fresh juice, November 7th, 1911 : specific gravity 1·085, malic acid ·78 per cent., tannin ·258 per cent. Weight of fruit, 947lbs. ; yield of juice, 663lbs. Average daily fall in specific gravity at 28°C., ·0038. Filtered January 4th, 1912 : specific gravity 1·044. Specific gravity in bottle, May 2nd, 1912 : 1·039. A sweet, brisk cider of considerable strength and body ; aroma very fair and flavour clean, but rather harsh. A useful cider unblended, but improved by the addition of a softer type.

Ditto (East Lambrook, Somerset).—Analysis of fresh juice, November 9th, 1911 : specific gravity 1·074, malic acid ·63 per cent., tannin ·252 per cent. Weight of fruit, 520lbs. : yield of juice, 398lbs. Average daily fall in specific gravity at 28°C., ·0032. Filtered January 23rd, 1912 : specific gravity 1·039. Specific gravity in bottle, May 2nd, 1912 : 1·039. A sweet, rich, rather brisk cider of good flavour and aroma. Typical of the variety, and useful unblended, but slightly inferior to some of the preceding.

Gatcombe (Long Ashton, Somerset).—Analysis of fresh juice, December 14th, 1911 : specific gravity 1·063, malic acid ·44 per cent., tannin ·244 per cent. Average daily fall in specific gravity at 28°C., ·0034. The pomace was divided into five portions, which were treated as follows :—

A.—Pomace allowed to stand over-night after milling, before pressing. Cider filtered January 16th, 1913 : specific gravity 1·035. Specific gravity in bottle, May 2nd, 1912 : 1·033.

B.—Pomace pressed immediately after milling, the cider racked at a gravity of 1·020, and never filtered. Specific gravity in bottle, May 2nd, 1912: 1·015.

C.—Pomace pressed immediately after milling, the juice keeved for 30 hours, then filtered direct from the keeve and again on January 17th, 1912, when the gravity had fallen to 1·041. Specific gravity in bottle, May 2nd, 1912: 1·038.

D.—Pomace pressed immediately after milling, the juice then allowed to ferment until February 1st, when it was filtered, the gravity then being 1·036. Specific gravity in bottle, May 2nd, 1912: 1·033.

E.—Pomace pressed immediately after milling, the juice filtered at once, and again on February 1st, 1912, when the gravity had fallen to 1·038. Specific gravity in bottle, May 2nd, 1912: 1·030.

All of the above ciders with the exception of *B* were of the same general character. The sweetness was marked, the aroma more or less pleasant, and the flavour very fair with slight briskness. They were of good body, and adapted for use unblended. *B* differed from the others in being much drier and more strongly alcoholic. Its flavour, although rather softer, was inclined to be coarse and lacked the delicacy of the others. The five ciders were placed in order of merit on the Annual Tasting Day, May 2nd, 1912, by a number of experts, the order being *D*, *E*, *C*, *A* and, a long way last, *B*.

Sweet Varieties—(including those containing normally less than ·45 per cent. malic acid and ·2 per cent. tannin).

Symes' Sweet (Martock, Somerset).—Analysis of fresh juice, November 10th, 1911: specific gravity 1·074, malic acid ·24 per cent., tannin ·396 per cent. Weight of fruit 1,061lbs.; yield of juice, 772lbs. Average daily fall in specific gravity at 28°C., ·0080. Filtered December 13th, 1911: specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912: 1·022. A strong, full-bodied and coarse cider of second-rate quality; flavour and aroma moderate. Lacks distinction, but fairly useful for blending on account of its strength.

Clusters (Heatherington, Devon).—Analysis of fresh juice, November 15th, 1911: specific gravity 1·057, malic acid ·24 per cent., tannin ·272 per cent. Weight of fruit, 827lbs.; yield of juice, 637lbs. Average daily fall in specific gravity at 28°C., ·0054. Filtered November 29th, 1911: specific gravity 1·039. Specific gravity in bottle, May 2nd, 1912: 1·023. A light, medium sweet cider of neutral character; aroma and flavour fair, but lacking in distinction Useful for blending.

Farmer's Friend. A. (East Lambrook, Somerset).—Analysis of fresh juice, October 17th, 1911: specific gravity 1·065, malic acid ·28 per cent., tannin ·342 per cent. Weight of fruit, 1,196lbs.; yield of juice, 950lbs. Average daily fall in specific gravity at 28°C., ·0150. Filtered November 3rd, 1911: specific gravity 1·017. Specific gravity in bottle, May 2nd, 1912: 1·005. A strong, coarse, dry cider of inferior merit; aroma and flavour indifferent. Requires blending. The fruit was washed with cold water before milling.

Ditto. B.—Analysis of fresh juice, October 17th, 1911: specific gravity 1·064, malic acid ·25 per cent., tannin ·300 per cent. Weight of fruit, 1,120lbs.; yield of juice, 926lbs. Average daily fall in specific gravity at 28°C., ·0150. Filtered November 6th, 1911: specific gravity 1·017. Specific gravity in bottle, May 2nd, 1912, 1·013. A cider similar to the preceding in general character, but rather sweeter and less coarse. The fruit was washed with hot water before milling.

Sweet Alphington, syn. Loram's Spotted White (Alphington, Devon).—Analysis of fresh juice, November 8th, 1911: specific gravity 1·068, malic acid ·34 per cent., tannin ·186 per cent. Weight of fruit. 939lbs.; yield of juice, 712lbs. Average daily fall in specific gravity at 28°C., ·0042. Filtered December 12th, 1911: specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912: 1·023. A strong, rather coarse, medium sweet cider; aroma fair, flavour characteristic and not very attractive. Useful for blending, but not of much value for use alone.

Burstout (Martock, Somerset).—Analysis of fresh juice, November 8th, 1911: specific gravity 1·064, malic acid ·19 per cent., tannin ·134 per cent. Weight of fruit, 986lbs.; yield of juice, 757lbs. Average daily fall in specific gravity at 28°C., ·0043. Filtered December 4th, 1911: specific gravity 1·038. Specific gravity in bottle, May 2nd, 1912: 1·026. A rich, sweet, neutral cider of excellent aroma and flavour. Pleasant alone, but improved by blending with a sharper type.

France. A. (Jersey).—Analysis of fresh juice, November 21st, 1911: specific gravity 1·051, malic acid ·35 per cent., tannin ·172 per cent. Weight of fruit, 2,004lbs.; yield of juice, 1,594lbs. Average daily fall in specific gravity at 28°C., ·0054. Filtered December 21st, 1911: specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912: 1·028. A typical example of a cider made from a variety belonging to the sweet class. Aroma well marked and pleasant; flavour good but lacking in briskness. Very useful for blending. Insipid alone.

Ditto. B.—Made from the same lot of juice as the preceding, the difference in treatment being that in this case the juice was filtered direct from the press before fermentation. Filtered again, December 18th, 1911: specific gravity 1·037. Specific gravity in bottle, May 2nd, 1912: 1·024. A cider closely resembling the preceding during the early spring of 1912. It developed sickness towards the end of April, 1912, whereas the former escaped until after Midsummer, thus illustrating the danger of checking the natural primary fermentation of the juice by filtration or other means.

Romeril. A. (Jersey).—Analysis of fresh juice, November 21st, 1911: specific gravity 1·054, malic acid ·37 per cent., tannin ·54 per cent. Weight of fruit, 2,162lbs; yield of juice, 1,606lbs. Average daily fall in specific gravity at 28°C., ·0054. Filtered December 19th, 1911: specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912: 1·019. A medium sweet, insipid cider of very fair aroma and flavour. Does not possess sufficient character alone, but is very useful for blending.

Ditto. B.—Made from the same lot of juice as the preceding, the difference in treatment being that the juice in this case was filtered direct from the press before fermentation. Filtered again, December 18th, 1911: specific gravity 1·038. Specific gravity in bottle, May 2nd, 1912: 1·029. A cider similar to the preceding, but sweeter, the filtration of the juice before fermentation proving, as in other cases, sufficient to delay fermentation.

Hangdown (Heatherington, Devon).—Analysis of fresh juice, November 10th, 1911: specific gravity 1·065, malic acid ·24 per cent., tannin ·284 per cent. Weight of fruit, 571lbs.; yield of juice, 377lbs. Average daily fall in specific gravity at 28°C., ·0039. Filtered February 13th, 1912: specific gravity 1·037. Specific gravity in bottle, May 2nd, 1912: 1·035. A rich, full-bodied cider; aroma and flavour good, but wanting in briskness. Very useful for blending.

Ditto.—Made from the same lot of juice as the preceding, but owing to natural clearing proving sffiucient to clarify it for bottling, it was never filtered.

Specific gravity in bottle, May 2nd, 1912 : 1·036. Resembles very closely the preceding, but slightly coarser in flavour and containing too much gas in bottle.

Eastham (Tenbury, Worcester).—Analysis of fresh juice, November 10th, 1911 : specific gravity 1·065, malic acid ·33 per cent., tannin ·246 per cent. Weight of fruit, 148lbs. ; yield of juice, 98lbs. Average daily fall in gravity at 28°C., ·0042. Filtered December 12th, 1911 : specific gravity 1·036. Specific gravity in bottle, May 2nd, 1912 : 1·030. A full-bodied sweet cider of decidedly neutral character : aroma not marked, flavour insipid. Useful for blending, but lacks character alone.

Slack-ma-Girdle (Bickington, Devon).—Analysis of fresh juice, November 15th, 1911 : specific gravity 1·055, malic acid ·27 per cent., tannin ·104 per cent. Weight of fruit, 1,188lbs. ; yield of juice, 947lbs. Average daily fall in specific gravity, ·0055. Filtered November 30th, 1911 : specific gravity 1·040. Specific gravity in bottle, May 2nd, 1912 : 1·025. A sweet, full-bodied neutral cider ; flavour and aroma very fair, but lacking in character. Too insipid alone, but useful for blending.

Slack-ma-Girdle (Alphington, Devon).—Analysis of fresh juice, November 8th, 1911 : specific gravity 1·068, malic acid ·33 per cent., tannin ·148 per cent. Weight of fruit, 1,277lbs. ; yield of juice, 865lbs. Average daily fall in specific gravity at 28°C., ·0051. Filtered December 14th, 1911 : specific gravity 1·041. Specific gravity in bottle, May 2nd, 1912 : 1·037. A rich, full-bodied cider of excellent quality and fruity character ; aroma and flavour good. Lacks acidity, otherwise very good alone, and excellent when blended with a brisker type.

Sweet Alford. A. (Alphington, Devon).—Analysis of fresh juice, October 25th, 1911 : specific gravity 1·058, malic acid ·27 per cent., tannin ·196 per cent. Weight of fruit, 930lbs. ; yield of juice, 702lbs. Average daily fall in specific gravity at 28°C., ·0043. Filtered November 27th, 1911 : specific gravity 1·036. Specific gravity in bottle, May 2nd, 1912 : 1·027. A sweet, full-bodied cider of typical Sweet Alford character, the aroma and flavour being, however, coarser and less pleasant than in some former seasons. The fruit was washed with cold water before milling. Sickness developed at the end of the summer.

Ditto. B.—Analysis of fresh juice, October 25th, 1911 : specific gravity 1·058, malic acid ·26 per cent., tannin ·220 per cent. Weight of fruit, 930lbs. ; yield of juice, 703lbs. Average daily fall in specific gravity at 28°C., ·0037. Filtered December 2nd, 1911 : specific gravity 1·037. Specific gravity in bottle, May 2nd, 1912 : 1·035. A cider very similar in character to the preceding, being rather more pleasant in the early summer, but coarser towards the end of the summer. Made from the same lot of fruit as the preceding, but the apples were washed with hot instead of cold water before milling. Did not turn sick.

Ditto. C.—Analysis of fresh juice, November 7th, 1911 : specific gravity 1·062, malic acid ·20 per cent., tannin ·236 per cent. Weight of fruit, 900lbs.; yield of juice, 695lbs. Average daily fall in specific gravity at 28°C., ·0029. Filtered December 15th, 1911 : specific gravity 1·040. Specific gravity in bottle, May 2nd, 1912 : 1·035. A cider of the same general character as *A* and *B* preceding, but fuller in flavour and more fruity. Made from the same lot of fruit as *A* and *B*, the fruit however being stored for a fortnight longer before milling, and not washed. Became sick in early summer.

Sweet Alford (Chulmleigh, Devon).—Analysis of fresh juice, November 28th, 1911 : specific gravity 1·062, malic acid ·16 per cent., tannin ·236 per cent. Aver-

age daily fall in specific gravity at 28°C., ·0034. Weight of fruit, 4,470lbs. ; yield of juice, 3,440lbs. The freshly pressed juice was divided into four portions and treated as follows :—

A.—Juice allowed to ferment until January 22nd, 1912, when the gravity had fallen to 1·042, and then filtered. Specific gravity in bottle, May 2nd, 1912 : 1·038.

B.—Juice filtered before fermentation, and again on January 22nd, 1912, when the gravity had dropped to 1·044. Specific gravity in bottle, May 2nd, 1912 : 1·039.

C.—Juice allowed to ferment until the gravity had fallen to 1·053, when it was filtered and sulphured. Specific gravity in bottle, May 2nd, 1912 : 1·038.

D.—Juice filtered before fermentation and then sulphured. Specific gravity in bottle, May 2nd, 1912 : 1·050.

The four resulting ciders were all of the usual Sweet Alford type, with more body than in most years. *A* and *B* were very much alike, while *C* and *D* suffered considerably in flavour owing to the sulphuring. They were adjudicated in order of merit on May 2nd, 1912, as follows : *B, A, C, D.* Later in the summer *A* and *B* developed sickness, *B* succumbing first, while *C* and *D* escaped.

Bittersweet Varieties—(including those containing normally less than ·45 per cent. malic acid and more than ·2 per cent. tannin).

Clifton Crab (Clifton, Glos.).—Specific gravity of fresh juice, November 29th, 1911 : 1·047. Weight of fruit, 230lbs. ; yield of juice, 162lbs. Filtered December 13th, 1911 : specific gravity 1·025. Specific gravity in bottle, May 2nd, 1912 : 1·018. A medium sweet, thin cider ; flavour and aroma moderate. Of second-rate quality only.

Russet Jersey (Long Ashton, Somerset).—Analysis of fresh juice, October 25th, 1911 : specific gravity 1·056, malic acid ·44 per cent., tannin ·476 per cent. Weight of fruit, 185lbs. ; yield of juice, 127lbs. Average daily fall in specific gravity at 28°C., ·0097. Filtered November 14th, 1911 : specific gravity 1·023. Specific gravity in bottle, May 2nd, 1912 : 1·018. A medium sweet, very bitter cider of fair body and quality ; flavour and aroma very fair Useful for blending, but much too bitter alone.

Early Red Jersey (Long Ashton, Somerset).—Analysis of fresh juice, September 22nd, 1911 : specific gravity 1·056, malic acid ·18 per cent., tannin ·616 per cent. Weight of fruit 1,370lbs. ; yield of juice 1,067lbs. Average daily fall in specific gravity at 28°C., ·0051. Filtered November 21st 1911 : specific gravity 1·016. Specific gravity in bottle, May 2nd, 1912 : 1·009. A very bitter, medium dry cider of fair body ; aroma fair, flavour fair but rather coarse. Fairly useful for blending when used in small proportion, but much too bitter alone.

Ashton White (Long Ashton, Somerset).—Analysis of fresh juice, September 23rd. 1911 : specific gravity 1·055, malic acid ·22 per cent., tannin ·430 per cent, Weight of fruit, 1,050lbs. ; yield of juice, 788lbs. Average daily fall in specific gravity at 28°C., ·0070. Filtered October 23rd, 1911 : specific gravity 1·018. Specific gravity in bottle, May 2nd, 1912 : 1·016. A raw and somewhat coarse medium cider ; aroma and flavour indifferent. Requires to be blended. The fruit from which this sample was made was washed in cold water before milling.

Ditto.—Analysis of fresh juice, September 23rd, 1911 : specific gravity 1·062, malic acid ·21 per cent., tannin ·516 per cent. Weight of fruit, 1,150lbs. ; yield

of juice, 882lbs. Average daily fall in specific gravity at 28°C., ·0064. Filtered October 20th, 1911: specific gravity 1·013. Specific gravity in bottle, May 2nd, 1912: 1·009. A cider similar to the preceding, but slightly softer. Made from the same heap of fruit as the preceding, but washed with hot instead of cold water before milling.

Ford's Jersey (Hereford).—Specific gravity of fresh juice, December 14th, 1911: 1·057. Weight of fruit, 277lbs.; yield of juice, 188lbs. Filtered January 1st, 1912: specific gravity 1·030. Specific gravity in bottle, May 2nd, 1912: 1·018. A medium sweet, somewhat bitter cider of moderate body; aroma fair, and flavour pleasant with a characteristic aromatic aftertaste. Useful for blending, but not brisk enough alone.

Belle Norman (Monmouth).—Analysis of fresh juice, November 7th, 1911: specific gravity 1·073, malic acid ·27 per cent., tannin ·488 per cent. Weight of fruit, 949lbs.; yield of juice, 722lbs. Average daily fall in specific gravity at 28°C., ·0107. Filtered November 24th, 1911; specific gravity 1·031. Specific gravity in bottle, May 2nd, 1912: 1·018. A strong, full-bodied, pleasant cider of medium sweetness; aroma and flavour good. Needs to be blended with a brisker type, but decidedly useful and a marked improvement on other ciders made from this variety in previous seasons.

Red Norman (Marden, Hereford).—Analysis of fresh juice, November 2nd, 1911: specific gravity 1·064, malic acid ·26 per cent., tannin ·216 per cent. Weight of fruit, 481lbs.; yield of juice, 371lbs. Average daily fall in specific gravity at 28°C., ·0079. Filtered October 27th, 1911: specific gravity 1·029. Specific gravity in bottle, May 2nd, 1912: 1·024. A pleasant medium sweet cider of fair body; flavour and aroma good. Too insipid for use alone, but useful for blending.

Dabinett (Long Ashton, Somerset).—Specific gravity of fresh juice, November 29th, 1911: 1·066. Filtered January 15th, 1912: specific gravity 1·025. Specific gravity in bottle, May 2nd, 1912: 1·024. A useful medium sweet cider with appreciable bitter character; aroma pleasant, flavour good. Well adapted for blending, but lacks briskness for use alone.

Médaille d'Or (Long Ashton, Somerset).—Analysis of fresh juice, October 25th, 1911: specific gravity 1·056, malic acid ·41 per cent., tannin ·636 per cent. Weight of fruit, 574lbs.; yield of juice, 455lbs. Average daily fall in specific gravity at 28°C., ·0057. Filtered November 20th, 1911: specific gravity 1·032. Specific gravity in bottle, May 2nd, 1912: 1·027. A sweet and very bitter cider of fair body; aroma and flavour fair. Much too bitter for use alone, and can only be used in low proportions in blends.

Major (Heatherington, Devon).—Analysis of fresh juice, November 22nd, 1911: specific gravity 1·067, malic acid ·34 per cent., tannin ·400 per cent. Weight of fruit, 2,801lbs.; yield of juice, 2,177lbs. Average daily fall in specific gravity at 28°C., ·0057. Filtered January 9th, 1912: specific gravity 1·034. Specific gravity in bottle, May 2nd, 1912: 1·030. A rich, full-bodied cider with slightly bitter aftertaste; aroma fruity, flavour very clean and good. Slightly lacking in briskness for use alone, but of first rate quality for blending.

Newton Red Jersey (Newton St. Cyres, Devon).—Analysis of fresh juice, November 14th, 1911: specific gravity 1·056, malic acid ·33 per cent., tannin ·332 per cent. Weight of fruit, 860lbs.; yield of juice, 685lbs. Average daily fall in specific gravity at 28°C., ·0045. Filtered December 14th, 1911:

specific gravity 1·041. Specific gravity in bottle, May 2nd, 1912 : 1·031. A rich, full-bodied cider of excellent quality ; aroma fruity, flavour pleasant with a characteristic aromatic aftertaste. Excellent for blending with a brisker type.

Yarlington Mill Jersey (North Cadbury, Somerset).—Analysis of fresh juice, December 14th, 1911 : specific gravity 1·053, malic acid ·18 per cent., tannin ·504 per cent. Weight of fruit, 1,058lbs. ; yield of juice, 808lbs. Average daily fall in specific gravity at 28°C., ·0063. Filtered January 19th, 1912 : specific gravity 1·038. Specific gravity in bottle, May 2nd, 1912 : 1·035. An excellent full-bodied rich cider of the best bittersweet type ; flavour and aroma very good and fruity. Not brisk enough for use alone, but of first-rate quality for blending.

Twistbody Jersey (Martock, Somerset).—Analysis of fresh juice, November 10th, 1911 : specific gravity 1·081, malic acid ·32 per cent., tannin ·558 per cent. Weight of fruit, 1,054lbs. ; yield of juice, 800lbs. Average daily fall in specific gravity at 28°C., ·0048. Filtered December 18th, 1911 : specific gravity 1·047. Specific gravity in bottle, May 2nd, 1912 : 1·035. A rich, strong full-bodied cider of good quality, but with bitterness very strongly marked ; aroma and flavour good. Very useful for blending, but can only be used in small proportions in blends.

Fréquin Audièvre (Truro, Cornwall).—Analysis of fresh juice, December 20th, 1911 : specific gravity 1·069, malic acid ·31 per cent., tannin ·448 per cent., Weight of fruit, 220lbs. ; yield of juice, 146lbs. Average daily fall in specific gravity at 28°C., ·0047. Filtered February 2nd, 1912 : specific gravity 1·037. Specific gravity in bottle, May 2nd, 1912 : 1·036. A rich full-bodied cider of excellent quality ; aroma fruity and flavour soft and pleasant with appreciable bitter aftertaste. Very nice alone, and excellent for blending.

Broadleaf Norman (Bishopston, Hereford).—Analysis of fresh juice, November 28th, 1911 : specific gravity 1·062, malic acid ·27 per cent., tannin ·128 per cent. Weight of fruit, 189lbs. ; yield of juice, 137lbs. Average daily fall in specific gravity at 28°C., ·0056. Filtered January 2nd, 1912 : specific gravity 1·038. Specific gravity in bottle, May 2nd, 1912 : 1·037. A useful, full-bodied, sweet cider, rather lacking in aroma, but of very good flavour. Hardly brisk enough for use alone, but very good for blending.

Glastonbury Jersey (Barton St. David, Somerset).—Analysis of fresh juice, November 21st, 1911 : specific gravity 1·079, malic acid ·37 per cent., tannin ·644 per cent. Weight of fruit, 1,108lbs. ; yield of juice, 826lbs. Average daily fall in specific gravity at 28°C., ·0078. Filtered December 13th, 1911 : specific gravity 1·047. Specific gravity in bottle, May 2nd, 1912 : 1·037. A rich, full-bodied cider of good quality ; aroma well marked and pleasant, flavour good, but with very decided bitter character. Very useful for blending.

PERRY.

Moorcroft (Cheltenham, Glos.).—Analysis of fresh juice, September 23rd, 1911 : specific gravity 1·070, malic acid ·56 per cent., tannin ·222 per cent. Weight of fruit, 942lbs. ; yield of juice, 729lbs. Average daily fall in specific gravity at 28°C., ·0042. Filtered October 30th, 1911 : specific gravity 1·017. Specific gravity in bottle, May 2nd, 1912 : 1·012. A pleasant medium dry perry of good body ; aroma well marked and flavour clean and characteristic. A good specimen of the perry typical of this variety ; blending not required. With earlier filtration a much sweeter beverage could have been obtained without difficulty.

A few remarks concerning individual varieties of particular interest and the vintage characters of the season may be added to the above details.

For the first time at the Institute a few foreign varieties were tested on a practical scale. Mr. H. B. Napier kindly arranged for a ton of each of two well-known Jersey varieties, France and Romeril, to be sent from that country. The fruit reached the Institute in excellent condition in spite of the long journey, and in that respect compared more than favourably with the average fruit supplied by growers in the West of England. Both varieties belonged to the sweet class and furnished ciders which for general character and quality could be classed with those of the Sweet Alford type. Although not of superlative merit, they proved quite up to the average of the ciders made the same season from English varieties belonging to the sweet class.

In addition to these two Jersey varieties, trials were made of two well-known French bitter-sweet varieties, Médaille d'Or and Fréquin Audièvre. The fruit in this instance was not grown abroad, some being supplied by Mr. Daubuz, from the Truro district, and the remainder having been grown on young trees in the cider orchard at the Institute. The Médaille d'Or cider, as anticipated, proved excessively bitter; and it is evident that only a very small proportion of this kind can be used in a blend. Fréquin Audièvre, on the other hand, gave a very rich, sweet, full-bodied cider, which, although rather lacking in briskness and possessing a slight bitter flavour, was very generally appreciated and adjudged excellent even when unblended.

Reference may also be made to the variety referred to in the above summary as Porter's Perfection. This apple obtained notoriety through certain paragraphs which appeared in numerous newspapers and other periodicals last summer, calling attention to the discovery of a wonderful new cider apple by the Institute. In view of numerous enquiries subsequently received, and also of the fact that there appeared afterwards in the press letters in which the writer asserted incorrectly that the variety referred to was one discovered and brought to the notice of the Institute by him and for which he claimed credit, it is desirable that its actual history should be given. In the autumn of 1907, while searching in the orchards around Martock for a supply of Cap of Liberty apples or other varieties which would serve as substitutes for that sort, my attention was called by Mr. Charles Porter of East Lambrook to a seedling tree growing in one of his orchards, which bore fruit resembling Cap of Liberty in appearance and, to some extent, in flavour also. At his suggestion the fruit was

sent to the Institute for trial that season as a substitute for Cap of Liberty. The cider made from it proved to be of such excellent quality that each year since that time, when the tree has borne a crop, the fruit has been procured for trial purposes at the Institute. The results have on the whole been so good that it is justifiable to regard the variety as one of the best kinds yet tested for the production of a medium brisk, light, bottling cider. It has frequently been referred to at cider exhibitions as an example of a variety of real value, existing practically unnoticed in an old orchard, which would in course of time have died out, if it had not been brought to notice by the work of the Institute. The press references were evidently based on a statement of that kind. Young trees have been propagated in the nurseries at the Institute from grafts and buds taken from the original tree, which up to that time was probably the only one of that sort in existence ; and these will be available for distribution shortly. A stock of grafts or buds of the variety can also be obtained from the Institute. It has been named Porter's Perfection after the grower, to whom is really due the credit of having in the first instance recognised its merit and of having drawn attention to it as a sort likely to prove worthy of investigation.

An interesting feature of the trials was the inclusion of a number of the older Herefordshire varieties of repute, such as Sam's Crab and Cherry Pearmain, which had not previously been tested at the Institute. It was noteworthy to find that, unlike many other of the old varieties of high reputation tested in previous seasons, they for the most part fully sustained the opinion formed as to their merits by cidermakers of past generations. In the case of the two varieties named this was particularly satisfactory, since they are locally considered to be of some value as market varieties. Growers have thus the benefit of their use for two distinct purposes.

The nature of the summer of 1911 raised high anticipations as to the probable quality of the cider produced from the fruit of that season. It must be admitted that those expectations were by no means fully realised in the results. Without any question it may be placed on record that the average quality for the season was distinctly higher than usual. At the same time the ciders made at the Institute in the single variety trials, as well as those exhibited in connection with the principal cider competitions during the summer of 1912, showed that there was a quite unexpected lack of examples of the highest degree of merit. There was in general no lack of sweetness, body, and strength ; but attached to those desirable features there were in most instances a coarseness in flavour, due frequently to excess of tannin or related substances, and an absence of any

special character beyond that of sweetness which rendered them by no means entirely pleasing in character. The fine flavoured ciders of well marked and delicate fruity aroma which are characteristic of some seasons were in 1912 generally conspicuous by their absence.

Such were the general impressions of the 1911-12 vintage left at the end of last summer, and to a large extent they still hold good. Writing at the end of the year, however, it may be said that they need some modification or qualification. The ciders to a larger proportion than in most years have shown improvement with advancing age, this being especially marked in the sweeter and heavier types. They still lack the delicacy which characterises the best type of cider, but the coarseness is being mellowed with age and tone is developing and replacing the featureless sweetness and insipidity. It seems now probable that this vintage will in future have to be regarded as one which was slow in developing and required time to show its real value. One interesting fact connected with the vintage remains to be recorded, this being that the disorder of sickness was by no means so common as had been anticipated.

The analytical data in connection with these ciders are of more than usual interest. As was to be expected after the hot, dry summer, the specific gravities of the juices were decidedly above the average. In many cases they were abnormally high, and the exceptional amounts of sugar resulted in the alcoholic strengths of the mature liquors being generally unusually pronounced. The acidities of the juices proved higher than had been anticipated, the presumption having been that the excessive sunshine and warmth would have caused very complete ripening and conversion of malic acid to sugar. Instead, however, the acidities as a whole were probably above the average, this certainly being the case with the great majority of sweet and bittersweet varieties. The tannin values of the juices were also distinctly above the average for most varieties, a feature which was easily apparent in the flavour of the ciders. The rates of fermentation of the juices were, as in the case of the acidities, somewhat higher than anticipated, being in many instances above the normal. Here again it was among the sweet and bittersweet varieties that the excess was most marked. In spite, however, of the rather high rate there was generally comparatively little difficulty in controlling the fermentations, the extra amount of sugar ensuring the continuation of the primary fermentation over a longer period than usual in most cases; while the natural clearing properties of the juices were generally well developed also. The ciders made in the first half of the season were, however, as usual much more difficult to manage than those made later, and in many

instances showed marked tendency towards renewed fermentations after the primary fermentation had been checked.

Taking the results for all the constituents usually estimated, it is clear that the juices for the season should be regarded generally as being more or less concentrated forms of the normal type. Undoubtedly the drought of the summer reduced the amount of water taken up by the trees, and the heat caused a greater degree of transpiration than usual. Thus all the constituents of the fruit would be affected in the same direction, and the somewhat unexpectedly high values for the acidities and rates of fermentation accounted for. In this connection it is noteworthy to find that the sharp varieties do not appear to have been so greatly affected as the sweets and bittersweets, a fact which seems to suggest that that class of apples may be more capable of withstanding dessicating influences than the other two classes. Possibly the osmotic or water-attracting properties of the malic acid which is present in greater abundance in the fruit of that class, may have some influence on the amount of water held by the tree, either by reducing the amount of transpiration or by increasing the absorption of water through the roots. The general characters of the 1911-12 vintage are well explained by the view that the juices were in a more concentrated form than usual, the somewhat striking coarseness and the marked slowness of maturing being the natural sequence.

Altogether the 1911-12 vintage season must be regarded as of exceptional interest not only to the cider-maker but also to the plant physiologist on account of the instructive facts revealed as to the effects of climatic conditions on the quality and composition of the fruit and the suggestive light thrown upon various aspects of the vital processes and chemical changes associated with the production of fruit.

CIDER SICKNESS.

In the report of last year a summarised account of the investigations on cider sickness, as far as they had proceeded up to that time, was given. Continuous attention has been paid to the subject in the laboratory during the past twelve months, and further information has been gained, principally in the direction of the chemical side of the question. The recent work has been dealt with in a paper read last December before the London Section of the Institute of Brewing, and a *résumé* of that article is here given.

It has already been proved that sickness is a bacterial disorder to which sweet ciders are liable. The bacteria which cause the malady are apparently more or less generally distributed in ciders, the available evidence leading to the conclusion that the organisms are to be found naturally occurring on the apples along with wild yeasts and other organisms of fermentation. As in the case of the latter, they find their way into the juice through the operations of milling and pressing the fruit, and their subsequent fate seems to be very largely determined by the quality of the juice in which they find themselves. In the case of rapidly fermenting juices there is evidence to show that they suffer from competition with the yeasts and fail on that account in most instances to get the upper hand after the cider has matured, with the result that the liquor escapes the disorder. Since in many cases also such rapidly fermenting juices ferment so completely that there is very little, if any, residual sugar left after the completion of the primary alcoholic fermentation, it follows that no outbreak of sickness occurs because the bacteria have no supply of the necessary sugar to enable them to produce the typical characters of the disorder. If, again, the juice is markedly acid in character, the cider remains generally immune owing to the inability of the organisms to flourish in the presence of much acid. On the other hand, if the juices are naturally of the slow fermenting type, the presence of relatively large quantities of unfermented sugar in the mature ciders produced from them renders them very susceptible to the disorder, provided that their acidity is not too marked. The presence of a sufficient supply of unfermented sugar coupled with the occurrence of the sickness bacterium in a comparatively active condition in the mature cider and a relatively low content of malic acid are, therefore, the factors favourable to the appearance of the disorder. Under such

conditions, when the temperature of the liquor rises with the approach of the warm summer weather, the bacteria develop more or less rapidly in the liquor, acting on the sugar to produce the chemical changes which are responsible for the characteristic features of the disorder. These changes consist in the decomposition of the sugar mainly into carbon dioxide and ethyl alcohol, together with small quantities of other substances, among which may be enumerated formaldehyde, acetaldehyde, methyl alcohol, hydrogen, and formic, acetic, propionic, butyric or valeric, and oxalic acids. The breaking up of the sugar accounts for the loss of sweetness, the production of a large quantity of carbon dioxide for the violent evolution of gas and the effervescence of the liquor, and the formation of comparatively large quantities of aldehydes and smaller amounts of other volatile compounds for the development of the characteristic flavour and aroma of sickness. Recent work has shown that the aldehydes must probably also be held responsible for the characteristic persistent frothy head typical of sick ciders and for the development of the dense turbidity of the liquor.

With regard to these two points it has been found that if acetaldehyde is added to sterilised cider, and the latter kept some weeks under aseptic conditions, a dense milky turbidity will gradually develope, and the liquor will acquire an odour reminiscent of sick cider. If at this stage lime water is added to the liquor, a considerable quantity of carbon dioxide is given off and a persistent frothy head, entirely resembling that of a sick cider, is produced by the evolved gas. This evolution of carbon dioxide and the consequent formation of the frothy head only occurs when the aldehyde has been in the cider long enough to cause the turbidity. If the lime water is added to the cider immediately after the addition of the aldehyde, no gas is given off and no frothing occurs. It appears probable, therefore, that acetaldehyde acts slowly on some constituent or constituents in cider, causing the formation of the insoluble substance to which the turbidity is due and at the same time bringing about a change which, on reduction of the acidity of the liquor by the addition of lime water, leads to the evolution of carbon dioxide and the accompanying production of the persistent froth.

There is additional evidence to connect the occurrence of the turbidity with the presence of aldehyde in a sick cider. The microscopic appearance of the insoluble substance which causes the turbidity is highly characteristic. It occurs in the form of minute oily or resinous looking droplets, some single and easily mistaken for individual bacterial cells, and others aggregated together so as to resemble very closely small colonies of cocci. The insoluble com-

pound resulting from the addition of acetaldehyde to sterile cider appears practically identical when examined under the microscope. The solubilities of the two compounds are also similar. Both dissolve more or less freely when the cider is warmed, separating out again on cooling. They are also soluble in alcohol, and are precipitated on the addition of much water to the alcoholic solution. Formaldehyde acts in very similar fashion to acetaldehyde, differing only in the much greater rapidity with which the turbidity makes its appearance and in the much larger quantity of the insoluble compound formed. In this case also the latter closely resembles, if it is not identical with, the substances formed in the other two cases. That the compound or compounds which cause the production of the turbidity in sick cider are volatile substances is proved by the following experiment. If a small wash bottle containing sterile cider is attached to a vessel containing cider in an active state of sickness, so that the gaseous and volatile products from the latter are made to pass through the sterile liquor, the latter in the course of some days will gradually become more and more turbid. An examination of the substance causing this turbidity then shows that it possesses the characters which have been described above as typical of the insoluble compound formed naturally in sick cider and of the similar compound resulting from the addition of aldehyde to sterile cider. That the turbidity in the sterile cider in the wash-bottle is not due to accidental infection with the sickness bacterium is proved by the fact that the liquor is still in a sterile condition at the end of the experiment.

The substance or substances in the cider on which the aldehydes act to bring about the formation of this insoluble compound belong in all probability to the class of constituents generally regarded as tannins. The evidence in favour of this view is now comparatively strong. If formaldehyde is added to cider and the liquor left until no further formation of the insoluble compound occurs, the cider after filtration no longer gives any of the ordinary reactions for tannin, thereby demonstrating that the tannins originally present have been destroyed or removed. If a quantitative estimation of the tannin in a cider is made by the ordinary permanganate method of analysis before and after addition of either formaldehyde or acetaldehyde, the tannin contents in the latter cases are invariably lower than those in the untreated cider; and within certain limits the more aldehyde added the greater is the amount of the reduction of the quantity of tannin shown.

The nature of this insoluble product of the action of the aldehydes

formed during cider sickness on the cider tannins is now under investigation by Dr. Nierenstein and Mr. C. W. Spiers in the biochemical laboratory of the University of Bristol, and the results of their work will be published in due course.

Reference has been made in earlier accounts of this work on cider sickness to the striking differences in the nature of the disorder met with in individual cases. For instance, the violence of the fermentation, as represented by the amount of gas evolved, and the extent to which it proceeds, as estimated by the amount of sugar destroyed, are both very variable. In some cases very little, and occasionally no, gas is given off, although the alteration in aroma and flavour and the appearance of turbidity show that sickness has developed. In other cases a violent fermentation sets in for a short period only, ceasing as suddenly as it began and leaving the cider still comparatively sweet with a relatively large amount of unfermented sugar. Sometimes a violent fermentation occurs and continues until practically the whole of the sugar present has been destroyed, although the aroma and flavour characteristic of sickness are not developed. Originally it seemed doubtful whether a fermentation of this type was to be attributed to the action of the sickness bacterium, but recent investigations have made it probable that it is really a modified form of sickness and is due to the action of the organism in question. Occasionally the turbidity generally associated with sickness does not develop or, if it appears, occurs to a very limited degree and amounts to very little more than a comparatively slight haziness. The study of the chemistry of the disorder has now shown that it is possible to account for all these variations in the character of the disorder and that they must be regarded as genuine cases of sickness.

Working with pure cultures of the organism and sterilised sugar solutions or ciders of known composition, quantitative analyses of the media after fermentation with the bacterium show that the amounts of sugar destroyed in individual cases vary considerably according to the conditions of the experiment. Not only so, the relative amounts of alcohol and carbon dioxide formed as the result of the decomposition of a given weight of sugar also vary widely. Sometimes the reaction occurs on lines very closely resembling ordinary alcoholic fermentation by yeast, approximately equal quantities of alcohol and carbon dioxide being produced and the total weights of the two compounds amounting to practically that of the sugar broken up. In other instances the amounts of alcohol and carbon dioxide differ widely, the quantity of the latter substance being more or less deficient. In extreme cases no appre-

ciable amount of carbon dioxide has been produced, although sugar has been broken up and alcohol formed. The variability of the cider sickness fermentation thus finds an exact parallel in the case of these pure culture fermentations.

It has now been demonstrated that the characteristic flavour and aroma of sick ciders must be attributed very largely, if not entirely, to the production of aldehydes during the fermentation. The work with pure culture fermentations has also proved that the quantities of these substances formed are, like those of alcohol and carbon dioxide, very variable. The results show that the cases of sudden fermentations of sweet ciders in hot weather already referred to, in which the typical aroma and flavour of sickness are almost or entirely absent, are explained by the absence of aldehyde formation or the production of those substances in quantities much less than the normal.

In this article reasons have already been adduced for the belief that the turbidity of sick cider is due to the action of the aldehydes produced during the course of fermentation on the tannins naturally present in the cider. In view of what has just been stated as to the variability in amount of aldehyde production, it is evident that the extent of the turbidity may be expected to vary in a similar way; and, as already noted, such variations are met with in practice.

The main differences in the characters of the various manifestations of cider sickness as they occur naturally, with which cider-makers are more or less familiar, have thus now been reproduced in the laboratory, working with pure cultures of the organism and sterilised sugar solutions or ciders. The question as to the conditions which are responsible for the variable behaviour is still under investigation.

Side by side with the study of the disorder in the laboratory, practical experiments in the cider house have been carried on to endeavour to find a satisfactory method of dealing with the liquor to prevent the outbreak of the disorder. Since it seems most probable now that the bacterium is present in the juice from the start, attention has been paid to methods by which the organism could be removed from or killed on the fruit before the latter is milled. Warcollier, in his experiments with French cider fruit, has shown that by washing it in a very dilute solution of formalin before milling a perfectly sterile juice can be obtained, which is at the same time free from the presence of the antiseptic. This method in the hands of careful workers is perhaps capable of useful application; but

it may be doubted whether it is desirable for general use. Experiments in washing the fruit in cold water have been tried at the Institute. While the results show that in some cases the cider is afterwards less liable to sickness, the method is by no means a sure preventive. Washing with hot instead of cold water has also been tried in a limited number of cases. The temperature of the water used was kept between 55° C. and 65° C., since it has been found that the cells of the bacterium are killed by five minutes' exposure to temperatures of 55° C. and over. In no cases in the ciderhouse have the ciders washed with hot water afterwards turned sick, while in some of the control lots made from the same fruit not subjected to the hot water treatment sickness has developed. The number of trials of this method have not yet been sufficiently numerous to form a conclusive estimate of its merits; but when the new additions to the cider buildings and equipment at the Institute have been completed, it will be tested more exhaustively and under better conditions. The washing of the fruit with hot water does not seriously impair the flavour of the juice. There is no trace of the cooked or pasteurised character about it. At the same time, during the course of the summer after it was made, a slightly coarse or bitter flavour became noticeable as the amount of sugar was reduced by fermentation; and this sufficed to make it distinguishable from and slightly inferior to the cider made from the same fruit unwashed, although not, according to present results, serious enough to render the method worthless on its account.

The effect of filtration of the fresh juice direct from the press has been tested. These trials, although not numerous, have given very conclusive results so far as they have gone. The filtration at that stage has the effect of delaying the beginning of the primary alcoholic fermentation brought about by the yeasts and, in some instances, of reducing to some extent the subsequent rate of fermentation. In all cases where the cider thus treated was of a kind susceptible to sickness, it was found that sickness set in more quickly and caused a severer attack in the ciders which had been filtered direct from the press than in those of the same kind which had, except for the omission of the early filtration, been treated in every way similarly. Experiments in other directions, *e.g.*, those dealing with the watering of ciders referred to in another section of this report, and others dealing with the manufacture of small cider, have shown likewise that if the form of treatment results in the reduction of the rate of fermentation of the juice, it renders the product more susceptible to sickness. It may probably now be taken as a general rule that any procedure—other than the sterilisation of the juice

or the addition of antiseptics—which tends to delay the onset of the primary fermentation and to reduce its rate also tends to render the liquor more susceptible to sickness. Hence it seems in the highest degree desirable that, in making cider under ordinary conditions, in all cases where sickness is feared efforts should be directed towards obtaining a vigorous and healthy fermentation in the juice as quickly as possible after pressing.

Further experiments in blending have once more completely confirmed the results given in earlier reports as to the influence of the acidity of the blend on the retardation of sickness. In many cases during the past season ciders in bulk have been by judicious blending prevented from becoming sick, which would, if they had been left unblended, have succumbed to the disorder.

There is now no question that if the facts which have been learnt as the result of these investigations are suitably applied, the risk of sickness may be very greatly reduced ; and there is considerable promise from the work at present in hand that cidermakers will eventually be able to obtain the mastery over this dreaded malady.

THE USE OF WATER IN CIDER MAKING.

The addition of water to cider has long been a subject of controversy among cider makers. Where the practice is adopted, the water is added in one of four ways. Sometimes it is mixed with the pomace before the latter is pressed for the first time, its addition being justified by those who adopt the custom on the ground that with the best presses obtainable it is impossible completely to extract all the juice—some 60–70 per cent. of the weight of the residual pomace after pressing being actual juice impossible of expression by ordinary means—and the added water simply facilitates the recovery of a portion of this otherwise wasted residual juice by displacing it in proportion to the amount of water used. In such cases a juice is obtained which partakes of the general character of a pure juice, being simply a slightly diluted form of the latter,—unless a disproportionate amount of water is used—with the loss of strength compensated for by the extra volume obtained and the avoidance of waste of useful material in the discarded pressed pomace.

A second method consists also in the addition of water to the pomace with the same object as in the previous case, viz., the recovery of unexpressed juice ; but in this instance the water is not added until the pomace has already been pressed once and the normal yield of pure juice obtained. The liquor obtained by this form of treatment is obviously much more dilute than that yielded in the former case, and is generally spoken of as " small " cider, " washings," or " seconds." It is recognised as an inferior grade and does not challenge comparison with pure juice cider in the same manner as the preceding kind.

A third method consists in the direct addition of water to the pure juice obtained by extraction from untreated pomace. It cannot be urged for the use of water in this case that it is required to avoid the wastage of juice in the pressed pomace ; but the claim is put forward that it is justified and even necessary for fruit grown on certain classes of soil in order to provide a juice, the fermentation of which is more easily controlled and the keeping qualities of the cider produced better. A similar claim is also put forward on behalf of the first method, in addition to that of avoiding wastage already referred to. As in the latter case, the cider made from juice thus directly watered is a competitor with pure juice cider.

The fourth method in which water is used consists in the addition

of that liquid to the cider after the latter has been fermented and is in fit condition for consumption. In this case it is simply a question of dilution in order to increase the bulk of the article and thus to add to the profits of the maker who places it in competition with pure juice cider. There can be no claim as in the former cases that it is justified either as a means of aiding the production of a better article or of utilising useful material which would otherwise be discarded.

In the investigations which have been made at the Institute during the past two seasons as to the actual results of the addition of water, the first and third methods only have been taken into consideration, since the second does not yield a product which is in any sense a genuine competitor with pure juice cider, and the fourth is obviously a case of adulteration pure and simple. The following remarks therefore only apply to the first and third systems.

These systems are in use in certain of the cider-making areas, and it is urged in perfectly good faith by many of those who adopt them that they result in the production of better ciders than the pure juice sytem for the average fruit of those localities. Hence, however distasteful it may be to those who hold literally to the pure juice standard for cider to be asked to countenance as legitimate the addition of a substance even of so innocuous a character as water, it must be admitted that, if it can be shown that its use results in the production either of a better article or of as good or only slightly inferior quality, with the advantages of fuller control and simplification of manufacture, then the case in favour of the practice is greatly strengthened. It was with the object of ascertaining how far such claims are justified that investigations on the subject were made at the Institute.

The claim in favour of watering appears to rest on two main grounds, viz., the superior keeping qualities of watered ciders, and the greater degree of control over the fermentation of the juices. It is probable, after examination of the subject, that these two points are really identical and are simply two different methods of expression of a single fact. Experiments show that it is quite certain that in one direction watered ciders are inferior in keeping qualities to pure juice ciders made from the same kinds of fruit. They are distinctly more liable to attacks of cider sickness. This is easily understood when their character is taken into consideration. Being in essentials in the fresh unfermented juice stage nothing more than the pure juice more or less diluted with water, it follows that the acidity is to a corresponding extent lower than that of the pure juice. Consequently, from what has already been proved with regard to cider

sickness, they must be more susceptible to the disorder on account of their lower acidity, assuming that the addition of the water does not impart to them some specific resistant power sufficient to counterbalance the effect of the reduction of acidity. No such immunity is imparted by the water, as far as direct observation has shown, and practical experience with the watered ciders has completely confirmed the expectation that they would be more susceptible to the malady. There is, in addition, another reason for their greater susceptibility. It will be seen from the results of experiments to be referred to in detail in subsequent paragraphs that the addition of water causes the rate of fermentation of the watered juices to be less than that of similar juices unwatered. This fact, the establishment of which is the most striking outcome of the experiments, is quite in accordance with expectation, since it is known that the principal factor in the juice determining the rate of fermentation is the content of nitrogenous substances available for yeast nutrition. The relative amount of these in the watered juice must be less than in the pure juice. Now the investigations on cider sickness have shown that anything which tends to reduce the rate of fermentation also tends to make the liquor more susceptible to the disorder. Thus the practice of watering the juice renders the cider more liable to sickness both by reducing the acidity and by lowering the rate of fermentation. Hence the claim that the addition of water gives the cider better keeping qualities is not only incorrect in the sense just described ; the actual result is quite the opposite, the cider being more likely to succumb. At the same time there may be some foundation for the claim in the following way. Since the rate of fermentation is lessened, the cider tends to keep sweet longer and the period over which the fermentation extends is prolonged. Hence the liquor is kept charged with carbon dioxide for a longer time, and acetification, possibly, is warded off—temporarily, at any rate—for that reason. Hard, dry ciders are also sometimes confused by some of the more inexperienced makers with those which are really unsound ; and the retention of sweetness for a longer period by the watered ciders is apt to mislead such people into assuming that the cider has kept better. Thus it seems probable that when the statement is put forward that the watered ciders keep better than the pure juice ciders, what is really meant amounts to nothing more than that they keep sweet longer or, in other words, that the fermentation is slower.

The other claim referred to, viz., that watered juices are more easily managed, amounts to precisely the same thing. The slower

rate of fermentation renders control easier, both racking and filtering being more effective in checking fermentation under such circumstances. In the face of the evidence about to be mentioned the tendency of watering to cause a reduction in the rate of fermentation cannot be denied; and, within limits at any rate, the contention of those who favour watering as a means to the production of a better cider is to that extent justified. How far the advantage of superior control of fermentation and the retention in some cases of an extra degree of sweetness is counterbalanced by the partial loss of the fruity flavour and aroma caused by the dilution of the juice with water is a question to which a general answer cannot satisfactorily be given. So much depends upon the characters of individual juices. Some pure juices may be so fully flavoured that a moderate dilution is of comparatively small account, and may in favourable cases pass undetected. Other juices, however, may be comparatively poorly equipped as regards flavour from the outset; and the dilution of such could not fail to yield a thin, watery cider of inferior merit, in spite of the extra sweetness which might be retained as the result of the retarding effect of watering on the rate of fermentation.

It is not proposed to set out in detail here the complete statistics of all the experiments which have been carried out in connection with this question of the effect of watering. The results as a whole point conclusively to the fact that the advocates of the practice must rest their case primarily upon the reduction of the rate of fermentation of the juice and the advantages which arise as the result of that reduction. It is only necessary, therefore, to refer to the experiments which demonstrate that a reduction in the rate actually occurs.

Similar series of experiments have been carried out with a number of different juices obtained from representative vintage varieties of apples procured from several localities. It may, therefore, be claimed for the results that they can be regarded as thoroughly representative and of general application. It may be stated at once that they show a very general measure of agreement, and that, where at certain stages some appeared discordant, the differences have been satisfactorily accounted for owing to the interference of disturbing outside influences which occurred on account of the conditions under which the experiments were carried out. The most troublesome complications were found to be due to the fact that sickness frequently set in before the conclusion of the normal primary alcoholic fermentation. It is now known that in the earlier experiments the records for the latter half of the fermentations

must be disregarded on this account. In the most recent series precautions have been taken to prevent the occurrence of sickness with the result that the figures obtained are more concordant. The effects both of the addition of water to the freshly milled pomace before pressing and also of its direct addition to the freshly pressed juice have been tested, the results being very similar in the two series. In the first case the pomace was divided into four lots, from one of which the juice was pressed without any addition, while to the other three water was added in the proportion of 10, 25, and 50 per cent. of the actual bulk of pomace respectively. The juices obtained from these three lots of pomace were then each divided into two halves, one being left untouched, and sugar added to the other in quantity sufficient to raise the specific gravity to the same figure as that of the pure juice from the unwatered lot of pomace. In the cases where the effect of the addition of water direct to the freshly pressed juice was tested, a given bulk of juice was divided into four lots, one being left without addition of water, and water added to the remaining three lots in the proportions of 10, 25, and 50 per cent. of the bulk of the pure juice. Each of the three latter was then divided into two halves, one being left untouched, and sugar added to the other in quantity sufficient to raise it to the same specific gravity as the pure juice. Thus there were in most of the experiments seven different grades of juice in both the series with the watered pomace and those with the watered juice. All of the juices were allowed to ferment at a temperature of 27° C., and regular records of the rate in fall of gravity were kept. Duplicate sets of the same juices were used as controls.

In the accompanying table the records of one series, in which Gatcombe was the variety tested, are given. In this series the pure juice was taken and watered as described above. The specific gravities of the watered juices were then brought up to 1·069, which was that of the pure juice itself, by the addition of sugar. The results show clearly the retarding effect of the addition of water on the rate of fermentation, the extent of retardation depending upon the amount of water added. The more water used the greater generally was the reduction in rate. Occasionally, however, anomalous results have been recorded, and these will require further investigation.

The fact of the reduction in rate by watering having been thus demonstrated, it now remains to consider whether or not the amount of the reduction is sufficient to be of practical value. Undoubtedly there are some instances, particularly in the case of some of the juices which naturally ferment slowly, where the reduction caused

by the addition of a comparatively small amount of water, such as 10 per cent., is pronounced enough to enable a useful degree of extra control over the fermentation to be obtained. In such cases, paradoxical as it may seem at first sight, it is possible at times to make a sweeter cider by adding water to the pomace or juice than by dealing with the undiluted juice. There are, however, many other cases where the reduction of the rate of fermentation by the addition of a moderate proportion of water is not great enough to

TABLE SHOWING COMPARATIVE RATES OF FERMENTATION OF WATERED AND UNWATERED GATCOMBE JUICES.

ORIGINAL SPECIFIC GRAVITY IN ALL CASES, 1069, THAT OF WATER BEING TAKEN AS 1000.

Period of fall.	Pure Juice.		Juice + 10 % Water.		Juice + 25 % Water.		Juice + 50 % Water.	
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
*Number of points fall in gravity from Dec. 15—Dec. 22 ..	8	8	11	10	11	10	8	7
*Ditto Dec. 22—Jan. 2 ..	17	15	15	15	11	12	9	10
Ditto Jan. 2—Jan. 4 ..	17	17	15	17	15	16	13	12
Ditto Jan. 4—Jan. 6 ..	7	7	5	4	4	5	3	2
Ditto Jan. 6—Jan. 8 ..	5	6	1	1	2	4	1	2
Ditto Jan. 8—Jan. 10 ..	3	4	2	2	1	• 1	2	2
Total fall Dec. 15—Jan. 10	57	57	49	49	44	48	36	35
Actual specific gravity, Jan. 10	1012	1012	1020	1020	1025	1021	1033	1034

* From December 15 to January 2 the juices in this series of experiments were kept at ordinary temperature; afterwards they were kept at 27°C.

allow of the fact being utilised to advantage in the control of the fermentation. Excessive watering is necessary in such cases to reduce the rate to a useful degree. In all cases it must be remembered that the addition of water causes a reduction in the original gravity of the juice corresponding to the amount added. Hence, although the rate of fermentation is reduced, there is proportionately less sugar to be fermented ; so that what is gained in time by the reduction in the rate is more or less counterbalanced by the shorter period required to ferment the smaller amount of sugar present in the juice. It is, therefore, extremely problematical whether any appreciable advantage is to be derived by the use of water as a general practice, while there are obvious drawbacks to its use on other grounds. At the same time in special instances a fair case in its support could be made.

INVESTIGATIONS ON CIDER-MAKING IN FRANCE.

Mr. O. Grove was appointed in the autumn of 1912 to the post of Oenologist at the Institute, and in future the major portion of the research work on the fermentation of cider will be in his charge. At the time of his appointment Mr. Grove was working in France, and it was considered a convenient opportunity for him, before coming into residence at Long Ashton, to visit the French cider districts to observe the methods in use in that country, and in particular to become acquainted with the experimental work being carried on by M. Warcollier at the Station pomologique at Caen.

Since it is believed that the cider-makers in this country will be interested in the result of Mr. Grove's observations as to the state of the industry in France, he has prepared the following brief report.

"Before starting work at the National Fruit and Cider Institute I had the opportunity of staying for a short time with Professor Warcollier, the well-known French cider expert, director of the "Station pomologique" at Caen (Normandy). This experiment station is supported by the French Government, and has for some time been conducting investigations on cider-making. It has several very good laboratories, but no real cider-making plant, so experiments cannot be made on a large scale at the present moment; it is, however, anticipated that a small cider-factory will be connected with the station later on.

During my stay I made myself acquainted with the methods of chemical and biological analysis employed, and the following account gives a short description of some of the problems and difficulties which occupy the French cider world at present.

One of the greatest difficulties in French cider-making is to obtain a perfectly clear cider. The French cider apples contain generally rather large amounts of pectic matter, and if most of this is not coagulated and precipitated in the first stages of the fermentation, it is very difficult to get rid of later on. Even repeated filtration is not successful; and very often it is necessary to have recourse to various systems of fining to obtain a clear liquid. It is, however, in France a general opinion that both filtering and fining should be omitted where possible, as they have, when not carried out very carefully, a bad influence on the cider, making it poorer in taste, body, and colour. To obtain good clarification it is recommended to ferment at a very low temperature, so as to have a very slow fermentation, the temperature preferred being 0°—6° C.; and this

means again waiting as long as possible before the pressing of the fruit, so as to work in the cold season. This applies specially to the small maker, who, as a general rule, has not a cold cellar at his disposition.

M. Warcollier is of opinion that in many cases maceration or soaking of the pomace will help to produce an early clearing of the cider, when this soaking is carried out under the proper conditions ; that is to say, for a period of not more than 24 hours, and the pomace kept as much as possible from contact with air in covered vessels without stirring. By maintaining the juice in connection with the pomace, the enzyme (pectase), which has a coagulating effect on the pectic matter, gets into solution in the juice and produces a quick coagulation and the rising to the surface of the fermenting liquid of what the French call " le chapeau brun " (the brown head) during the beginning of the fermentation.

This soaking is specially recommended when working with acid varieties, in the case of which the coagulation is difficult to obtain ; but it is not advisable with sorts rich in tannin, a substance which checks the coagulation. When working with apples of the third season of ripening, which have been stored for a long time before pressing, and in which the pectic material is in a state of semi-coagulation, giving a viscous juice, the soaking is not advised ; but in the case of apples of the first season of ripening, where the coagulation is always more difficult, soaking is strongly advised. In any case the soaking must not be over 24 hours. When longer, fermentation sets in, and substances of bad odour and taste are very often formed.

When it is not possible to get a sufficiently low temperature to assure a slow fermentation and good clarification, it is usual to add to the juice as it leaves the press a certain amount of sulphurous acid (1 to 3 gram per hectolitre), or, what is simpler, to burn a sulphur match in the casks before filling, (one match per 10 hectolitres), in no case exceeding 10 grams of sulphurous acid per hectolitre (the maximum allowed by the law) : or, if the coagulation is not set up early enough, to add to the juice different salts, of which especially are used bicalcium phosphate, calcium saccharate, or tartaric acid, with carbonate of calcium. These salts are added in small quantities of not more than 0·3 to 0·4 grams per litre. If a sweet cider is wanted, bicalcium phosphate must not be applied because it introduces phosphoric acid, which is a nutrient for the yeast and consequently accelerates the fermentation. The ideal is, of course, not to add anything at all to the juice, but to obtain the desired slow fermentation by working at a low temperature. This is,

however, in many cases impossible, especially in the case of the small maker, who has no means of artificial refrigeration. It is hoped in France to create co-operative cider factories, where it will be possible to treat the juice under the best conditions and consequently to get a better and more constant product.

To produce the first coagulation in the cider, keeving is very often practised. In a large cider factory which I visited, this process was carried out in square wooden vessels, and generally finished in three or four days. It is dangerous to keep the juice longer in open vessels, because of the acetification which will set in. After a day or so the formation of the "brown head" begins, and the juice gradually separates into three layers, the head on the surface, then the clear liquid in the middle, and a deposit at the bottom of the keeve. The clear liquid is carefully drawn off and filled into the fermenting casks, which are kept at low temperature (5—6° C.), and the principal fermentation started. The farmers use for the same purpose casks of from 6 to 20 hectolitres capacity, which they sometimes fill completely, so that the brown head works out through the bung-hole. At other times the casks are only filled to a certain height, so as to prevent this overflow. The latter method is preferred. In any case the racking is carried out as quickly as possible after four to six days, as it is considered advantageous to rid the juice of its impurities as soon as possible. The first racking is of great importance, because it takes away a certain amount of yeast and consequently helps the cider to ferment slowly. It also removes the harmful organisms which are removed with the deposit and the head.

For the storage of cider vessels of cement are being more and more used in France. These tanks are lined with glass inside; and where the glass plates join, silicate of potash or paraffin is employed for the joints. The glass-lined cement tanks present several advantages. They are cheaper than wooden vessels, of nearly unlimited capacity and durability, easy to clean, give no loss by evaporation, and keep the cider absolutely out of contact with the air. As they can be constructed in very large sizes, it is possible to keep the cider several years, when the fermentation has been carried out under good conditions.

As there is an increasing demand for sweet cider, M. Warcollier has proposed three different methods for obtaining that result. The first method consists in stopping the fermentation at a certain moment by starving the yeast, by suppressing the nitrogen nutriment necessary to its development. He carries this out by aerating the juice during the first steps of the fermentation, in this

way favouring the development of the yeast, which, under those conditions, instead of giving an alcoholic fermentation is growing quickly and increasing greatly in quantity. If all nitrogen nutriment is taken up in the yeast cells, it is simply a case of racking the cider from the yeast deposit, and then as the cider contains only a trace of nutriment for the yeast, fermentation will soon stop. Apple juice is poor in nitrogen, containing on an average 0·01 per cent., and as the dry yeast contains about 10 per cent. of nitrogen, it means only producing one gram of yeast per litre of juice to get all the nitrogen absorbed. Laboratory experiments have proved this to be quite possible. In practice it is recommended to obtain the first clarification of the juice by working in large open vessels, so as to get free contact with air, and, after the first clarification has taken place, to rack into other open vessels. Then a thin foam consisting of yeast is formed at the surface, and there is also a deposit of yeast. The surface yeast is skimmed off, and the cider racked from the deposit into another open vessel, where the same operation is repeated. Finally the cider is filtered and put into casks. This method is not applicable with all juices. The juices most suitable are those with a specific gravity of about 1·075, and an acidity of 0·3 to 0·4 per cent. One risks by insufficient aeration getting a too quick alcoholic fermentation, and with juices containing less acid, it happens that the tannin gets too rapidly oxydised by the action of the oxydase and air, which sometimes results in a black cider.

The second method recommended is also based on the behaviour of the yeast, when in contact or not with air. Experience has shown that the yeast is not capable of living indefinitely without air, and if a series of cultures is made excluding the air, the yeast is not capable of fermenting. Pasteur has demonstrated that, when a liquid containing sugar is fermented completely without air and with traces only of yeast, it is possible to make the fermentation interminable, which means to keep the liquor sweet. Later, M. Mazé has shown that the life of the yeast without air is limited because the enzyme, zymase, which splits up the sugar in alcohol and carbonic acid, disappears by degrees, when the yeast lives without air. This being the case a part of the sugar remains untouched, and it is possible to obtain a juice more or less fermented, by regulating the quantity of the initial yeast and the growth of the same by giving more or less air. Starting from these principles, M. Warcollier has carried out a series of laboratory experiments, which have shown that it is possible to obtain a sweet cider by suitable racking without access of air, so as to operate the fermentation with traces of yeast and no air. I quote here one of his experiments. A juice of specific

gravity 1·048 (sugar 10·51 per cent.), was fermented in four different ways :—

	Specific Grav.	Sugar.	Alcohol.
No. 1 (fermentation without air, with traces of yeast) ..	1·031	6·15%	2·5%
No. 2 (fermentation without air, with much yeast) ..	1·005	0·77%	6%
No. 3 (fermentation with air and traces of yeast)	1·004	0·58%	6%
No. 4 (fermentation with air and with much yeast) ..	1·004	0·6%	6%

The fermentations were completely finished after forty-four days, No. 1 was completely clear and kept clear without re-starting fermentation, and was much superior in quality to Nos. 2, 3 and 4, which were cloudy and dry. As a conclusion, the following industrial method is proposed by M. Warcollier. After the first clarification has taken place, the clear liquid is introduced into a fermenting vessel of special construction. This vessel has the shape of an upright cylinder with a conical base ending in a short tube with a cock. At the upper end the cylindrical vessel is perfectly closed, but communicates with the air through three or four openings, one having a tube for putting in communication with carbonic acid gas, the second opening with a tube for a syphon lock, the third with a tube with cock for filling, and the last for applying a pressure gauge, if it is wished, to ensure a certain pressure of carbonic acid. The cylindrical part of the vessel can be supplied with inspection windows for ascertaining if the contents are clear, and with a thermometer pocket for observing the temperature. This apparatus can be made of glass-lined cement, varnished wood, or enamelled metal, and must be placed on a stand in such a manner that the cock at the base is in a convenient height from the ground. To obtain a slow fermentation, the vessel is best placed in a cellar with low temperature. The juice introduced contains only a small quantity of yeast, as a great deal has been separated out by the preliminary keeving, and the fermentation goes on slowly, when the temperature is sufficiently low. As soon as a certain precipitation, consisting of pectic, albuminous, mineral and tannic matters, and an amount of yeast, is formed, the cock placed in the bottom is opened, so as to evacuate this deposit. At the same time carbonic acid gas is allowed to pass in at the top. This operation is repeated as often as necessary, until all the deposit and nearly all the yeast are evacuated. The small amount of yeast remaining, is, by having lived

without air so long, quite incapable of fermenting the remaining sugar, and the result is a cider remaining sweet. It is maintained that it is easy with this process to obtain a perfectly clear and sweet cider with a very fine flavour and taste and saturated with carbonic acid gas, which can be delivered in casks, bottled immediately or kept as long as wanted in the cellar.

A third method for obtaining a sweet cider is indicated by M. Warcollier, and is based on the following principle. When the yeast is living without air, the sugar-decomposing agent, zymase, is destroyed more and more rapidly at temperatures approaching 37—40° C. Consequently when carrying out a fermentation at a temperature of 37—40° C., without access of air, the fermentation stops very quickly, and the liquid remains sweet. When the fermentation is finished, the liquid is rapidly cooled down, and the deposit formed evacuated from the cylindro-conical vessel as mentioned above.

During my stay at the station several cases of green cider were successfully treated. It frequently happens in France that the cider developes a greenish colour. This colour is produced by a compound of iron and tannin. If the ciders are low in acidity, soluble ferrous salts are oxydised during the making into ferric salts, which form with the tannin basic compounds of a green colour. These ferri-tannates are decomposed by tartaric acid; and generally the green colour can be removed from the cider by adding 0·5 gram of tartaric acid per litre. In some cases it happens that an addition of tartaric acid is not sufficient to decompose the green compound. It is supposed then that the ferri-tannates are combined with the pectic matter. In such cases it has been found suitable to add a little tannic acid and aerate the cider. A strong green coloured secretion is formed, which can be precipitated by the addition of a little isinglass or casein. In one case a very good result was obtained by adding a very small amount of oxygenated water and afterwards 0·2 gram of tannin and 0·2 gram of gelatine per litre.

A few cases of oily or ropy cider were successfully treated by aerating the cider vigorously, and then adding 0·15 gram of tannin and 0·15 gram of casein per litre. Cases of oily cider are not uncommon in France, and it is both found in casks and in bottles. It is produced by the growth of a bacterium in the cider. This bacteria produces volatile acids, alcohol, mannite, and a mucilagenious substance. It is generally the sweet ciders in bottles that are attacked. The malady starts by a cloudiness which first appears in the lower part of the bottle and gradually works upwards; after some time the cider is seen to clear in the opposite direction, and

when examined is found to be oily and contain a growth of the bacteria.

It is, however, sometimes difficult to improve a cider which has gone wrong, and in that case it is often used for making cider-brandy. Some sugar is added, and the cider is re-fermented and distilled. Many of the cider-factories in France have small distilleries and make cider-brandy, which is consumed in large quantities and, when old, sold at very high prices. The lees are much used for making brandy.

The employment of pure culture yeasts for cider making is not yet generally adopted in France, as is the case in Germany. According to M. Warcollier, it is impossible to decide as to the influence of the pure cultivated yeast upon the cider at the present moment, because the experiments carried out on a large scale have to be repeated in different ways before any final judgment can be given.

Several samples of the better known French varieties of cider apples were collected and forwarded to the Institute for analysis The results will be found in the section of this Report which contains the analyses of the juices examined during the autumn of 1912."

LOCAL INSTRUCTION IN CIDER-MAKING.

It has been recognised for some time that the experimental and advisory work which is being carried on at the Institute needs to be supplemented by some scheme which should bring that work and its results to the notice of individual cider-makers and farmers, and at the same time provide them with facilities for becoming acquainted with the most-up-to-date and approved methods of cider-making, and for assistance in their own individual difficulties. Without some such scheme the value of the Institute to the industry must to a great extent be lost, because the benefits to be derived from it fail to reach those in whose interest the institution was in the first instance established. To bring the farmer and the cider-maker into personal touch with the work it is essential that some form of local instruction and advice should be provided in order that the special difficulties and local conditions of individual cases can be properly dealt with. The local instruction and assistance should be given by a suitably qualified instructor, who should be closely in touch with the work of the Institute, if not actually a member of the staff.

Local instruction in cider-making has been from time to time provided by the Agricultural Education Committees of certain of the counties in the West of England ; but until recently Monmouth and Hereford were the only two counties where its provision has been regularly and systematically catered for. In those instances the work has been conducted quite independently, although the instructor in his unofficial capacity happens to have been closely in touch with the Institute. Three years ago the Somerset County Agricultural Instruction Committee decided to arrange for instruction to be provided in that county, and after negotiation with the Institute, an arrangement was arrived at by which the Institute undertook the responsibility of providing an instructor for the work on condition that the expenses of the work and the major portion of the instructor's salary were paid by the County Council. Under this arrangement any resident in the county was able to obtain free of charge the services of the instructor on making application to the County Agricultural Education Department. The nature of the instruction provided may be seen from the following syllabus:—

Gathering and Storage of the Fruit.
Characters and uses of the various Classes of Cider Apples.
Blending of the Fruit.

Selection and Preparation of Casks for Cider.
Preparation of the Mill and Press for Cider making.
Building of the Cheese.
Maceration of the Pomace prior to pressing (where such treatment is desirable).
Keeving of the freshly expressed Juice (where desirable).
Fermentation of the Juice and its management during active Fermentation. The use of the Hydrometer. Racking and Filtration (where desirable).
Storage of Cider after Fermentation.
Blending of Ciders.
Bottling of Ciders (where desirable).
Improvement of low-quality Ciders by Re-soaking.

For the first year the instruction was given by Mr. M. Fritter, at that time cider-maker at the Institute. For the past two years, 1911 and 1912, Mr. A. W. Ashford, of Chedzoy, Bridgwater, who received two season's special training at the Institute for the purpose, has acted as instructor. At first the number of applications received was few; but, as the work became better known, more interest was taken, and during the 1912 season, Mr. Ashford's time was practically fully occupied. Twenty different applications for his services were made, and fifty-seven days were spent on the work. The following summary of Mr. Ashford's report for 1912 may be of interest as showing the nature of the questions on which advice is most needed, and the directions in which mistakes in practice are most commonly made.

"Some applicants for advice appeared to think that it ought to be possible to prescribe some simple form of treatment by which without additional trouble to themselves their cider could be produced equal in quality to a high-grade wine. In such cases their attention may be called to the fact that the quality of cider depends principally upon two factors, the natural quality of the fruit used, and the care and attention given to all details in connection with the making of the cider from the time when the fruit begins to ripen on the trees until the cider itself is ready for consumption. If the fruit is inferior in quality the best methods of making and the greatest care will not suffice to produce a good article. If, on the other hand, want of care or faulty treatment occurs at any time during the period specified there is a risk of ruining the cider, even though it may be made from fruit of the highest quality. Except in rare cases close attention and care are necessary; and unless the maker is prepared to take a reasonable amount of trouble, good results can hardly be expected.

One of the commonest mistakes is that of milling the fruit before it is properly ripe. In many cases trouble of this kind is brought about by mixing varieties of different seasons of ripening at the time of harvesting the fruit, with the result that some of the fruit in the mixture is bound to be overripe or underripe at the time of milling. Great improvements in the ciders have been effected by simply taking care only to mix together sorts which ripen at approximately the same period.

In one case complaint was made by the maker that his cider was invariably inferior to that of his neighbours, although the fruit was practically the same in the respective cases. Examination of his casks showed that some were leaky, and therefore allowed air to reach the cider and cause acetification, while the majority were foul through insufficient cleansing. It was also the practice not to drive home the bungs properly after fermentation had quieted down, acetification following on that account also. By using fresh casks in good repair, and taking precaution to exclude air by bunging securely and keeping the filled casks on their sides instead of on their heads a marked improvement followed.

In another instance a serious mistake was made by gathering the fruit from the trees before it was properly ripe, one of the latest varieties being gathered as early as September in order that the orchard might be cleared. In this case the grower was persuaded to leave a part of the fruit ungathered until much later in the season ; and the cider made from this lot proved greatly superior to that made from the same kind of fruit gathered when obviously unripe.

Metal utensils, such as iron shovels, galvanised bowls and buckets, iron wire strainers, and iron funnels are frequently used with the result that the cider is much subject to discolouration after exposure to air. This difficulty has been easily remedied by the substitution of wooden and tinned appliances.

There is a general tendency to disregard cleanliness, both as regards casks and the mill and press. In such cases the flavour of the cider is almost invariably tainted.

While there is usually a desire to retain sweetness in the cider, the maker as a rule has no means of doing this except by racking or the use of antiseptics. The latter practice is not encouraged. Racking occasionally gives fair results if the fruit happens to be suitable ; but generally it is quite inadequate for the purpose. A filter is greatly needed for demonstration purposes in this class of work.

Attention needs to be drawn more frequently to the prevalence of many varieties in the orchards which are totally unsuited for

making good cider. Where possible, if the trees are not too old, it is very desirable to re-graft them with vintage varieties of better quality."

From opinions expressed by many of those who have availed themselves of the instruction provided in Somerset it is evident that the work has been appreciated and that useful results have been achieved. The scheme is now getting more widely known in the county, and it may be anticipated that in future there will be a still further increase in the demand for the services of the instructor.

There are still some counties in the cider-producing area which have at present made no provision for local instruction. As a temporary expedient the Institute offered the services of Mr. Ashford for the cider-making season of 1912 to all of the contributing counties as far as his time was not required for the work in Somerset. Enquiries were received from Devon, Gloucestershire and Worcestershire, for his assistance. It was, however, only possible to arrange for a demonstration in Gloucestershire. Next season there will probably be an extension of the scheme in at least one, and possibly all of these counties. The whole subject, including both the training of suitable Instructors and the provision of advanced courses at the Institute as well as local arrangements in the counties, is now under consideration. It is probable that a large proportion of the cost of the work will be met by a grant from the Board of Agriculture out of that portion of the Development Grant set aside for Farm Institute and allied work.

STOCK INFLUENCE UPON VINTAGE QUALITY AND OTHER CHARACTERS OF APPLES.

This subject has received attention in the last five Annual Reports, and was considered at some length in the Report for 1912, wherein a detailed description of the experiments in progress will be found. It is not proposed this year to enter into a close examination of the additional data obtained from the analyses of the 1912 crop of fruit, since the results in general support the remarks made a year ago, and, while suggesting further ideas in certain directions, need to be supplemented by more records before they can be profitably discussed.

In Table A at the end of this section the analyses of Dabinett juices from the intermediate stock experiments for 1912 are given, together with the average results of individual trees for the period 1908–1911. Comparatively wide variations will be noticed in the 1912 results, as in those for single years referred to in previous Reports : while the averages for the whole period during which the records have been taken show how the results for individual trees tend to approximate to the same standard. The natural inference is that the intermediate stock plays but a comparatively minor part in determining vintage quality, and may indeed not exert any appreciable influence. When the fact that the rootstock of all the trees probably varies,—since they are all standards worked on the "free" or so-called "crab" stock,—is taken into consideration, the tendency of the average results to approximate to the same figure certainly suggests that both intermediate stocks and rootstocks of the crab and free type as a whole are factors of inconsiderable, if not negligible, importance where vintage quality is concerned. So sweeping a conclusion is, however, perhaps, hardly justified at this comparatively early stage.

Table B sets out the same results for 1912, and also the averages for the years 1908–12, where available, the trees, however, in this case not being arranged in alphabetical order, but in their order as they stand in the row in the orchard. It was pointed out in last year's Report how in rather remarkable fashion the variations in the results of individual trees did not occur in altogether haphazard fashion, but were distributed with some regard for regularity along the course of the row. The same kind of thing may be observed in the 1912 results. Thus, taking the specific gravities as an illustration, trees 1–7 form one group. The first shows a relatively high gravity, the second shows it rather lower, the third reaches the lowest level, to be followed by the next three with slight increase, and finally the

seventh with a rise to almost the standard of the first. From tree 7 to tree 13 the gravity is maintained at a comparatively high level, although not quite a uniform one. Trees 14–17 constitute a group with low gravities ; and finally there is a sharp rise through tree 18 to a very high figure for tree 19. The same kind of behaviour can be traced also in the case of the figures for acid, tannin, and rate of fermentation, although the actual groupings do not necessarily coincide. Nor do the groups coincide absolutely with the corresponding cases in previous years.

In the face of this periodicity in the results year after year it is impossible to disregard the fact that the situation of any tree in the row determines to a marked degree its results. All the trees are practically equally placed as regards sun ; the slope of the orchard is very slight and almost regular ; and there is nothing in the character of the adjacent rows on either side to warrant the assumption of local influence from that direction. Consequently the secret of the phenomena appears to rest in the soil. Since the extent and position of the groupings is not always strictly the same from year to year, local soil variations will hardly serve to explain the results. Some variable local factor in the constitution of the soil is apparently implied. The moisture content is the natural factor which suggests itself. This might conceivably act directly and simply by affecting the water supply of the trees, or possibly, by causing variations in soil temperature and, therefore, in root activity, or some other less obvious means. On the other hand, its action more probably might be a complex one due to the combination of several methods of influence. A series of experiments is now being started to endeavour to obtain further information on this point.

At this stage it is necessary to give attention to the methods by which vintage quality, *i.e.*, the composition of the juice, is estimated. At present they are admittedly unsatisfactory and inadequate in many respects. In some directions this is at present unavoidable, since the trees are still quite young. The size of the crop available for examination is, therefore, small, and the difficulty of obtaining fair average samples correspondingly great. This source of error will disappear in time, as the trees grow larger. In other directions, *e.g.*, the methods of analysis, improvement might be effected more quickly. The method of estimation of tannin, which is one of the most unsatisfactory, will probably be rendered much more accurate as the result of recent work which has been done in this connection by Dr. Nierenstein and Mr. C. W. Spiers, in the Biochemical Laboratory at Bristol University. It is hoped to have this in use in time for next season's work. In spite, however, of the comparatively

crude methods hitherto available there can be no question that they have sufficed to produce results which, although not so strongly marked as they might be with better methods, nevertheless are decisive enough to bring out the points discussed above.

Table C contains the analyses of Dabinett and Cap of Liberty juices from bushes on the Paradise rootstock. In most instances an intermediate stock has been employed, as with the Dabinett trees just referred to. There is a difference in the manner of employment of the intermediate stock in these cases, however, in that at least one branch, and frequently several of the intermediate stock has been left ungrafted or in several instances two or three other varieties have been also grafted on the same bush in addition to the sorts named. It will be noticed that there are extensive variations in the composition of the juices from the different bushes and that they are on the whole decidedly wider in range than those met with in the trees of the same varieties referred to in Tables A and D. The most striking case is that of Cap of Liberty on the Broadleaf Norman stock, where the variety shows a composition approaching that of a sweet rather than of a pronounced sharp apple, which is the normal condition. Until the crops get heavier it will not be possible to attempt to draw conclusions as to the influence either of the Paradise rootstock or the various intermediate stocks. The present figures are given to show how considerable are the variations which are being obtained, and, therefore, how important it is to endeavour to settle the question of stock influence.

In Table D are given the results of the analyses of the juices from the individual trees in the young orchard at the Institute. In previous reports they have been considered in connection with the experiments as to the influence of grass on the trees. Since grass has now been allowed to grow around all the trees, those experiments in their original form may be considered as closed. The effect of grass on the growth of the trees has been fully dealt with in earlier reports. Its influence upon the composition of the juice was not sufficiently clear from the results to allow of positive deductions being drawn. Since the results have some bearing on the question of stock influence and also serve to illustrate both the variation in composition of individual trees of a variety and the manner in which the variation is distributed according to the position of the trees in the row, a fact already referred to in more detail in connection with the Dabinett analyses, they are included in this section. There is no occasion at present to consider them more fully, since they illustrate to a lesser degree the considerations already discussed in the review of the Dabinett results.

TABLE A. Composition of Dabinett Juices from Intermediate Stock Experiments.

Variety of Intermediate Stock.		Composition of Juice, 1912.				Average Composition of Juice, 1908-11.			
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C. (1909-11 only.)
Annie Elizabeth	Tree 1	1.062	.13	.395	5.7	1.064	.24	.319	8·0
Ditto	Tree 2	1.065	.15	.385	5.5	1·062	.20	.333	9·6
Blenheim Orange	Tree 1	1.058	.13	.370	6.0	1·060	.20	.365	8·6
Ditto	Tree 2	1.063	.14	.425	4.4	1.063	.19	.322	—
Bramley's Seedling	Tree 1	1.055	.12	.290	7.2	1.062	.18	.397	9·3
Ditto	Tree 2	1 056	.11	.275	7.0	1.062	.24	.305	9·4
Broadleaf Jersey	..	1.060	.11	.315	5.2	1.066	.16	.342	10·9
Broadleaf Norman	..	1.055	.12	.260	5.5	1.059	.25	.306	9·2
Court Royal ..	..	1.056	.14	.260	5.7	1.061	.23	.340	8·4
Ecklinville	Tree 1	1.060	·15	.295	7.7	1.062	.20	.329	10·1
Ditto	Tree 2	1.055	.12	.250	7.0	1.063	.23	.341	8·4
Hardwicke ..	..	1.054	.11	.250	7.5	1.064	.21	.370	11·6
Hollow Core ..	..	1.058	.13	.310	8.3	1.061	.24	.318	9·2
King of the Pippins	..	1.052	.09	.210	11.0	1.059	.20	.294	10·0
Morgan Sweet	Tree 1	1.060	.13	.325	6.1	1.061	.19	.359	4·7
Ditto	Tree 2	1.061	.13	.340	6.2	1.062	.21	.312	5·5
Ditto	Tree 3	1.059	.11	.295	6.4	1.063	.24	.310	6·2
Ditto	Tree 4	1.060	.08	.300	5.9	1.064	.20	.373	7·1
Ditto	Tree 5	1.056	.12	.315	5.7	1.064	.23	.348	7·4
Ditto	Tree 6	1.062	.16	.410	4.8	1.058	.19	.298	10·2
Newton Wonder ..	Tree 1	1.067	.14	.370	9.0	1.068	.22	.355	—
Ditto	Tree 2	1.071	.16	.450	6.6	1.062	.20	.335	—
Ditto	Tree 3	1.057	.14	.300	6.0	1.060	.20	.245	—
Ditto	Tree 4	1.058	.12	.330	6.8	1.059	.18	.317	9·4
Peasgood's Nonsuch	..	1.062	.12	.380	6.0	1.055	.22	.240	10·8
Sweet Alford ..	..	1.061	.15	.360	6.1	1.060	.24	.266	10·3
Warner's King	Tree 1	1.055	.12	.300	6.0	1.063	.19	.311	10·2
Ditto	Tree 2	1.071	.15	.590	5.0	1.065	.20	.305	—
Average ..	..	1.060	.13	.334	6.4	1.062	.21	.326	9.2

TABLE B.—Composition of Dabinett Juices.

Order of Tree in Row.	Composition of Juice, 1912.				Average Composition of Juice, 1908-12.			
	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C. (1909-12 only.)
1. (Morgan Sweet)	1·062	·16	·410	4·8	—	—	—	—
2. (Broadleaf Jersey)	1·060	·11	·315	5·2	1·065	·15	·337	9·5
3. (King of the Pippins)	1·052	·09	·210	11·0	1·058	·18	·277	10·2
4. (Hardwicke)	1·054	·11	·250	7·5	1·062	·19	·346	10·6
5. (Warner's King)	1·055	·12	·300	6·0	1·062	·18	·309	9·1
6. (Bramley's Seedling)	1·055	·12	·290	7·2	1·061	·17	·376	8·8
7. (Ecklinville)	1·060	·15	·295	7·7	1·062	·19	·321	9·5
8. (Blenheim Orange)	1·058	·13	·370	6·0	1·059	·18	·366	7·9
9. (Annie Elizabeth)	1·065	·15	·385	5·5	1·063	·19	·344	8·6
10. (Newton Wonder)	1·058	·12	·330	6·8	—	—	—	—
11. (Peasgood's Nonsuch)	1·062	·12	·380	6·0	1·057	·20	·268	9·6
12. (Hollow Core)	1·058	·13	·310	8·3	1·061	·22	·316	9·0
13. (Sweet Alford)	1·061	·15	·360	6·1	—	—	—	—
14. (Broadleaf Norman)	1·055	·12	·260	5·5	1·058	·22	·297	8·3
15. (Court Royal)	1·056	·14	·260	5·7	1·060	·21	·324	7·7
16. (Ecklinville)	1.055	·12	·250	7·0	1·061	·21	·323	8·0
17. (Bramley's Seedling)	1·056	·11	·275	7·0	1·061	·21	·299	8·8
18. (Blenheim Orange)	1·063	·14	·425	4·4	1·063	·18	·342	—
19. (Warner's King)	1·071	·15	·590	5·0	—	—	—	—

TABLE C.—Composition of Juices from Bushes on Paradise Rootstock.

Name of Variety.	Intermediate Stock.	Composition of Juice, 1912.			
		Specific Gravity.	Malic Acid, per cent.	Tannin per cent.	Rate of Fermentation.
Cap of Liberty	Broadleaf Jersey	1·052	·50	·232	13·0
Ditto	Ditto	1·056	·66	·208	10·5
Ditto	Broadleaf Norman	1·046	·34	·100	18·0
Ditto	Ditto	1·057	·49	·200	15·5
Ditto	Cremière	1·053	·73	·258	11·0
Ditto	Médaille d'Or	1·056	·53	·170	14·5
Ditto	Ditto	1·050	·54	·242	17·0
Ditto	Ditto	1·056	·57	·228	9·9
Dabinett	None	1·060	·07	·445	12·0
Ditto	Brown Jersey	1·085	·14	·600	5·8
Ditto	Cummy Norman	1·070	·11	·470	8·1
Ditto	Kingston Black Improved	1·061	·10	·320	8·0
Ditto	Ditto	1·056	·09	·290	10·5
Ditto	Fréquin Audièvre	1·075	·14	·515	10·6
Ditto	M. Jacques, No. I.	1·057	·09	·390	15·5
Ditto	,, No. II.	1·057	·06	·310	11·5
Ditto	Neverblight	1·061	·10	·330	9·5
Ditto	Redstreak	1·059	·07	·375	8·0
Ditto	Rouge de Tréves	1·058	·11	·330	4·0
Ditto	White Styre	1·055	·08	·390	13·5
Ditto	Ditto	1·056	·09	·380	3·0
Ditto	Woolston Spice	1·054	·06	·340	10·0
Ditto	Dove	1·051	·17	·225	12·0

TABLE D. Composition of Juices from Young Orchard Trees.

Name of Variety.	Number of Tree.	Composition of Juice, 1912.				Average Composition of Juice, 1909-12.			
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 Deg. C.
Bédan des Partes (head-grafted on Broadleaf Jersey in 1906)	1	1·060	·19	·422	4·4	—	—	—	—
Ditto	2	1·055	·19	·270	10·7	—	—	—	—
Ditto	3	1·057	·21	·235	11·7	—	—	—	—
Broadleaf Norman	1	1·047	·23	·164	9·2	1·053	·21	·163	8·6
Ditto	2	1·050	·19	·182	6·7	1·052	·22	·187	7·3
Ditto	3	1·046	·18	·164	5·7	1·051	·21	·196	7·7
Ditto	4	1·047	·20	·168	7·0	1·048	·22	·185	7·1
Ditto	5	1·049	·18	·198	3·9	—	—	—	—
Ditto	6	1·053	·19	·208	2·3	1·052	·21	·185	5·8
Ditto	7	1·049	·20	·208	2·7	—	—	—	—
Ditto	8	1·044	·18	·212	2·9	1·045	·17	·159	—
Ditto	9	1·044	·21	·160	9·7	—	—	—	—
Ditto	10	1·047	·19	·262	3·6	1·052	·18	·204	—
Ditto (on Paradise Stock)	64	1·052	·13	·190	13·0	—	—	—	—
Ditto (ditto)	66	1·044	·09	·092	11·0	—	—	—	—
Ditto (ditto)	67	1·052	·07	·162	13·0	—	—	—	—
Ditto (ditto)	68	1·049	·08	·126	12·2	—	—	—	—
Cap of Liberty (head-grafted on Morgan-Sweet in 1906)	1	1·050	·71	·164	8·7	—	—	—	—
Ditto	2	1·062	1·07	·408	5·0	1·063	·97	·383	7·5
Ditto	3	1·051	·84	·232	10·2	1·062	1·16	·333	—
Ditto (head-grafted on King of the Pippins in 1906)	1	1·045	·63	·152	13·5	—	—	—	—
Ditto	2	1·046	·54	·080	16·5	1·051	·93	·229	—
Ditto	5	1·043	·54	·080	18·5	—	—	—	—
Ditto (head-grafted on Broadleaf Jersey in 1906)	2	1·047	·70	·108	18·5	—	—	—	—

Cherry Norman	1	1·060	·20	·368	8·0	1·056	·17	·313	6·4
Ditto	2	1·054	·21	·268	5·0	1·053	·17	·269	—
Ditto	4	1·054	·22	·320	10·7	1·055	·21	·334	—
Ditto	5	1·050	·22	·272	7·0	1·052	·21	·284	—
Ditto	7	1·056	·22	·304	5·8	1·049	·20	·248	—
Ditto	8	1·052	·21	·328	4·5	1·051	·18	·264	6·9
Ditto	10	1·052	·20	·296	6·7	—	—	—	—
Chisel Jersey	1	1·051	·18	·276	6·8	1·059	·25	·420	—
Ditto	2	1·068	·21	·708	7·2	1·062	·23	·514	5·9
Ditto	3	1·070	·20	·696	7·8	—	—	—	—
Ditto	4	1·055	·22	·408	4·2	—	—	—	—
Ditto	5	1·058	·13	·240	4·0	1·060	·24	·375	4·6
Court Royal	1	1·048	·31	·120	12·5	—	—	—	—
Ditto	2	1·045	·24	·120	15·5	1·049	·27	·127	—
Ditto	3	1·057	·27	·088	16·0	1·053	·26	·134	—
Ditto	4	1·046	·23	·074	20·0	1·054	·25	·134	—
Ditto	5	1·045	·22	·162	8·6	—	—	—	—
Cowarne Red	2	1·053	·56	·190	10·7	1·050	·64	·190	8·6
Ditto	3	1·049	·59	·225	10·0	—	—	—	—
Ditto	6	1·050	·62	·275	8·7	—	—	—	—
Ditto	7	1·051	·62	·325	7·5	1·047	·60	·226	—
Ditto	10	1·050	·58	·250	6·0	1·046	·62	·216	—
Ditto (on Paradise stock)	60	1·052	·56	·255	10·2	—	—	—	—
Cremière (head-grafted on Morgan Sweet in 1905)		1·052	·20	·132	12·7	1·050	·24	·152	13·3
Doux Amer (head-grafted on Broad-leaf Jersey in 1905)		1·052	·26	·238	4·7	1·052	·38	·183	—
Dymock Red	1	1·061	·27	·118	13·0	1·058	·36	·108	—
Ditto	2	1·058	·29	·156	11·7	1·057	·37	·115	—
Ditto	4	1·060	·41	·200	—	1·062	·41	·145	—
Écarlatine (head-grafted on Warner's King in 1905)	2	1·055	·29	·108	12·2	—	—	—	—
Ditto	3	1·050	·19	·076	8·5	—	—	—	—
Eggleton Styre	1	1·055	·26	·118	13·0	1·064	·29	·124	—
Ditto	2	1·048	·21	·130	11·2	—	—	—	—
Ditto	3	1·052	·23	·120	11·0	—	—	—	—

TABLE D—*continued.*

Name of Variety.	Number of Tree.	Composition of Juice, 1912.				Average Composition of Juice, 1909-12.			
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg.C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.
Eggleton Styre	4	1·036	·23	·098	11·0	1·052	·28	12·7	—
Ditto	5	1·042	·21	·088	14·5	—	—	—	—
Ditto	6	1·056	·26	·154	7·5	1·059	·27	·129	—
Ditto	8	1·059	·26	·116	9·5	1·059	·26	·129	—
Ditto	9	1·059	·25	·116	9·3	1·062	·27	·133	—
Ditto	10	1·052	·24	·118	5·8	—	—	—	—
Fréquin Audièvre (head-grafted on Broadleaf Jersey in 1906)		1·055	·19	·352	5·6	—	—	—	—
Ditto (on Paradise stock)	85	1·054	·20	·178	10·0	—	—	—	—
Harry Masters' Jersey (head-grafted on Warner's King in 1906)	1	1·054	·09	·234	7·2	1·062	·23	·393	9·9
Ditto	2	1·054	·21	·232	7·7	1·062	·32	·353	—
Ditto	3	1·053	·12	·368	5·5	—	—	—	—
Ditto	4	1·058	·20	·322	5·5	—	—	—	—
Ditto	5	1·056	·15	·282	5·5	1·061	·25	·356	6·0
Ditto (on Paradise stock)	135	1·057	·04	·280	—	—	—	—	—
Ditto (ditto)	136	1·061	·16	·350	10·2	—	—	—	—
Ditto (ditto)	137	1·060	·20	·240	13·2	—	—	—	—
Kingston Black	1	1·050	·61	1·95	8·0	1·053	·48	·196	—
Ditto	2	1·050	·35	·140	2·9	1·055	·49	·151	—
Ditto	3	1·046	·29	·114	3·9	1·056	·47	·146	—
Ditto	4	1·069	·51	·162	4·2	—	—	—	—
Ditto	5	1·056	·40	·130	5·2	1·060	·47	·185	—
Knotted Kernel	1	1·057	·13	·192	7·0	—	—	—	—
Ditto	2	1·057	·12	·212	11·5	—	—	—	—
Ditto	3	1·056	·16	·258	10·0	—	—	—	—
Ditto	4	1·060	·18	·228	12·5	—	—	—	—
Ditto	5	1·054	·14	·202	6·5	—	—	—	—

Ditto	6	1·057	·17	·224	10·0	—	—	—	—
Ditto	7	1·052	·15	·206	9·7	—	—	—	—
Ditto	8	1·057	·16	·200	11·2	—	—	—	—
Ditto	10	1·056	·21	·302	5·5	—	—	—	—
Médaille d'Or	1	1·059	·34	·764	7·0	1·064	·32	·661	10·3
Ditto	2	1·049	·29	·552	5·3	1·060	·28	·619	10·2
Ditto	3	1·052	·27	·668	4·9	1·059	·28	·661	10·5
Ditto	9	1·069	·39	1·000	7·4	1·064	·31	·720	8·8
Ditto	10	1·077	·38	·944	13·8	1·065	·31	·670	11·2
Ditto (head-grafted on Broadleaf Jersey in 1906)		1·052	·24	·648	6·4	—	—	—	—
Ditto (on Paradise stock)	56	1·055	·18	·262	11·2	—	—	—	—
Ditto (ditto)	59	1·076	·25	1·240	9·7	—	—	—	—
Ditto (ditto)	63	1·079	·16	1·350	9·1	—	—	—	—
Neverblight (head-grafted on Hardwicke in 1905)	2	1·056	·58	·302	4·1	—	—	—	—
Ditto (ditto in 1906)	3	1·051	·60	·196	3·6	—	—	—	—
Ditto (ditto)	4	1·051	·54	·212	3·8	—	—	—	—
Ditto (on Paradise stock)		1·051	·38	·136	11·7	—	—	—	—
Reinette Obry (head-grafted on Morgan Sweet in 1905)	1	1·047	·39	·132	10·2	1·053	·69	·126	9·1
Ditto	2	1·049	·47	·080	10·7	—	—	—	—
Ditto	3	1·053	·33	·145	12·0	1·052	·68	·114	11·3
Ditto (on Paradise stock)		1·056	·47	·150	—	—	—	—	—
Skyrme's Kernel	1	1·040	·56	·270	7·5	—	—	—	—
Ditto	2	1·039	·49	·250	7·5	—	—	—	—
Ditto	3	1·042	·65	·270	8·7	1·050	·67	·282	—
Ditto	7	1·046	·65	·280	10·0	1·054	·58	·312	11·7
Ditto	8	1·046	·61	·260	9·0	1·053	·59	·304	—
Ditto	9	1·047	·64	·270	9·2	—	—	—	—
Ditto	10	1·042	·52	·220	7·7	—	—	—	—
Strawberry Norman	1	1·048	·27	·340	9·2	—	—	—	—
Ditto	2	1·047	·25	·372	10·7	—	—	—	—
Ditto	3	1·049	·28	·480	9·2	—	—	—	—
Ditto	4	1·046	·28	·396	9·7	—	—	—	—
Ditto	6	1·050	·30	·432	8·7	1·058	·30	·376	8·7

TABLE D—*continued.*

Name of Variety.	Number of Trees.	Composition of Juice, 1912.				Average Composition of Juice, 1909-11.			
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.
Strawberry Norman	7	1·050	·28	·372	10·0	1·058	·31	·388	8·0
Ditto	8	1·051	·31	·420	11·7	—	—	—	—
Ditto	9	1·055	·36	·492	12·0	1·061	·36	·455	—
Ditto	10	1·054	·35	·456	13·0	—	—	—	—
Ditto (on Paradise stock) ..	82	1·061	·15	·420	13·5	—	—	—	—
Ditto (ditto)	83	1·058	·16	·500	11·5	—	—	—	—
Sweet Alphington (head-grafted on Ecklinville)		1·051	·24	·094	9·2	—	—	—	—
Ditto	2	1·048	·29	·100	11·5	—	—	—	—
Ditto	3	1·053	·20	·098	12·7	—	—	—	—
White Jersey (head-grafted on Broadleaf Jersey)	1	1·046	·13	·048	7·0	—	—	—	—
Ditto	2	1·047	·12	·058	5·9	—	—	—	—
Ditto	3	1·047	·12	·062	5·0	—	—	—	—
Ditto	4	1·043	·13	·076	1·7	—	—	—	—
Ditto	5	1·048	·13	·038	8·0	—	—	—	—

NOTE.—In the above Table, in addition to the results from the young orchard standard trees, are included some for certain of the varieties which are growing in an adjoining plantation in bush form on the Paradise stock.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation.	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES.							
ASH'S APPLE	1·033	5·75— 7·75	·12	·086	5·5	G. Ash	Newton St. Cyres D.
ASHTON WHITE	1·055	11·25—13·25	·33	·324	7·2	Cider Institute	Long Ashton S.
BROADLEAF NORMAN	1·038	7—9	·36	·158	5·7	Ditto	Long Ashton S.
BROWN THORN	1·051	10·25—12·25	·24	·198	6·5	E. Clark	Tenbury W.
BEDAN DES PARTES	1·075	16·25—18·25	·18	·452	14·7	L. Warcollier	France
BICKINGTON GREY	1·047	9·25—11·25	1·00	·146	7·7	F. W. Barter	Littlehempston D.
BOUTEILLE	1·061	12·75—14·75	·18	·272	19·2	L. Warcollier	France
BRAMTOT	1·102	26—28	·25	·784	11·4	Ditto	,,
BUTTERBOX	1·046	9—11	·53	·152	5·0	J. W. F. Bickford	Barton D.
CAP OF LIBERTY	1·045	8·75—10·75	·75	·170	4·8	C. Porter	East Lambrook S.
CHERRY PEARMAIN	1·043	8·25—10·25	·38	·142	4·2	J. Davies	Marden H.
CHISEL JERSEY	1·055	11·25—13·25	·32	·465	8·2	C. Porter	East Lambrook S.
COAT JERSEY	1·047	9·25—11·25	·18	·266	10·0	J. H. Symes	Martock S.
CROLLON	1·064	13·5 —15·5	·19	·336	5·0	L. Warcollier	France
CREMIERE	1·046	9·0 —10·0	·17	·170	11·5	HarperAdams Coll.	Newport, Shropshire
CRAB	1·044	8·5 —10·5	·91	·550	4·8	Hillier & Sons	Winchester
DABINETT	1·053	10·75—12·75	·35	·238	4·5	Cider Institute	Long Ashton S.
DAY'S No. I.	1·070	15—17	·16	·546	8·3	F. Day	Bridgwater S.
,, No. II.	1·075	16·25—18·25	·62	·220	5·9	Ditto	Ditto S.
,, No. III.	1·060	12·5 —14·5	·22	·198	6·0	Ditto	Ditto S.
,, No. IV.	1·055	11·25—13·25	·20	·268	7·0	Ditto	Ditto S.
DEVONSHIRE SWEET	1·050	10—12	·27	·140	6·4	G. Day	Fiddington S.
DOUX GESLIN	1·079	17·25—19·25	·30	·752	7·1	L. Warcollier	France
DYMOCK RED	1·038	7—9	·42	·156	5·2	C. Smith	Ledbury G.
EARLY RED JERSEY	1·048	9·5 —11·5	·21	·174	4·6	Cider Institute	Long Ashton S.
ECARLATINE	1·060	12·5 —14·5	·14	·220	—	Ditto	Ditto
EGGLETON STYRE	1·044	8·5 —10·5	·39	·132	6·2	Ditto	Ditto
EGGLETON STYRE	1·075	16·25—18·25	·24	·182	9·5	Earl Beauchamp	Madresfield W.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation.	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
ELLIS, No. 1	1·055	11·25—13·25	·18	·142	7·2	A. E. Ellis ..	Newton St. Cyres D.
FAIR MAID OF TAUNTON ..	1·047	9·25—11·25	·55	·192	4·2	R. Allen	Martock S.
FERTILE DE CAEN	1·051	10·25—12·25	·14	·164	12·5	Cider Institute ..	Long Ashton
FOXWHELP (Reputed)	1·049	9·75—11·75	·45	·086	6·0	Col. Cary Batten ..	Keyford
Ditto	1·046	9—11	·68	·138	4·8	C. Smith	Ledbury G.
Ditto	1·050	10—12	·47	·072	5·1	Col. Cary Batten ..	Keyford
Ditto	1·060	12·5 —14·5	·73	·370	6·3	Earl Beauchamp ..	Madresfield Court W.
FREDERICK	1·047	9·25—11·25	1·01	·110	9·0	D. Powell	Newton Court M.
FRENCH WHITE	1·046	9—11	·43	·132	10·0	E. Clark	Tenbury W.
FREQUIN ROUGE	1·069	14·75—16·75	·25	·384	6·0	L. Warcollier ..	France
GRISE DIEPPOIS	1·085	18·75—20·75	·23	·384	7·9	Ditto	France
HAUCHECORNE	1·077	16·75—18·75	·19	·562	6·3	Ditto	France
KINGSTON BLACK	1·054	11—13	·55	·168	5·1	W. Hancock ..	Ashill S.
Ditto	1·046	9—11	·43	·122	3·5	Cider Institute ..	Long Ashton S.
Ditto	1·040	7·5—9·5	·29	·136	3·3	F. R. Wilcox ..	Oldbury G.
Ditto	1·046	9—11	·45	·170	4·8	J. Davies	Marden H.
Ditto	1·068	14·5 —16·5	·33	·212	3·3	H. Copeland Batten	Sherborne D.
Ditto	1·055	11·25—13·25	·48	·144	4·3	T. A. May ..	Staplegrove S.
Ditto	1·051	10·25—12·25	·47	·162	3·2	Rev. Dowdeswell ..	Tewkesbury G.
Ditto	1·070	15—17	·39	·212	4·1	Col. Cary Batten ..	Keyford S.
Ditto	1·055	11·25—13·25	·40	·120	6·7	J. Tarzewell ..	Norton Fitzwarren S.
Ditto	1·051	10·25—12·25	·43	·148	5·7	S. Creed	White Lackington S.
Ditto	1·055	11·25—13·25	·44	·150	5·8	G. Jakeman ..	Ripple S.
Ditto	1·047	9·25—11·25	·44	·188	2·4	H. J. Phelps ..	Tibberton G.
Ditto	1·042	8—10	·35	·142	4·7	A. Allard	Tewkesbury G.
LADY'S FINGER	1·046	9—11	·65	·086	10·2	Cider Institute ..	Long Ashton S.
LAMBROOK PIPPIN	1·043	8·25—10·25	·51	·215	2·7	C. Porter	East Lambrook S.
Ditto	1·042	8—10	·51	·220	4·0	J. H. Symes ..	Martock S.

LISTERS No. I.	1·040	7·5 —9·5	·42	·132	8·7	E. G. Lister ..	Trowbridge W.
,, No. II.	1·052	10·5 —12·5	·69	·060	10·7	Ditto	Ditto W.
,, No. III.	1·047	9·25—11·25	·64	·078	9·0	Ditto	Ditto W.
,, No. IV.	1·043	8·25—10·25	·49	·086	8·7	Ditto	Ditto W.
,, No. V.	1·056	11·5 —13·5	·77	·154	10·2	Ditto	Ditto W.
,, No. VI.	1·076	16·5 —18·5	·65	·196	18·0	Ditto	Ditto W.
MARIN-OUFROY	1·071	15·25—17·25	·34	·324	11·0	L. Warcollier ..	France
MEDAILLE D'OR	1·051	10·25—12·25	·20	·688	5·2	Harper Adams Coll.	Newport, Shropshire
Ditto	1·092	20·5 —22·5	·26	1·740	11·4	L. Warcollier ..	France
MEUNIER DUR	1·057	11·75—13·75	·28	·504	9·0	Ditto	France
MORGAN SWEET	1·040	7·5 —9·5	·23	·078	11·0	Cider Institute ..	Long Ashton S.
NEVERBLIGHT	1·048	9·5 —11·5	·42	·170	9·0	Harper Adams Coll.	Newport, Shropshire
NEWTON RED JERSEY ..	1·045	8·75—10·75	·29	·186	3·3	A. E. Ellis ..	Newton St. Cyres D.
NEWTON SWEET	1·048	9·5 —11·5	·23	·194	6·0	G. Ash	Ditto D.
NOEL DES CHAMPS	1·065	13·75—15·75	·28	·352	7·6	L. Warcollier ..	France
OLD BITTERSWEET, No. I ..	1·064	13·5 —15·5	·18	·214	3·9	Earl Beauchamp ..	Madresfield Court W.
OLD BITTERSWEET, No. II.	1·060	12·5 —14·5	·21	·232	6·0	Ditto	Ditto W.
PALEY	1·048	9·5 —11·5	·19	·130	7·2	J. W. F. Bickford ..	Barton D.
POCKET	1·047	9·25—11·25	·27	·214	6·2	F. W. Barter ..	Littlehempston D.
PULL COURT RED	1·046	9—11	·76	·158	3·7	Rev. Dowdeswell ..	Tewkesbury G.
PYTHERES	1·046	9—11	·32	·154	7·2	D. Powell	Newton Court M.
RED NORMAN	1·055	11·25—13·25	·30	·262	3·7	E. Clark	Tenbury W.
RED SOLDIER	1·051	10·25—12·25	·76	·166	6·2	A. Edwards ..	Tewkesbury G.
Ditto	1·052	10·5 —12·5	·93	·208	5·8	E. Clark	Tenbury W.
ROLLER	1·051	10·25—12·25	·25	·125	6·3	J. W. F. Bickford ..	Barton D.
ROYAL WILDING	1·046	9—11	·18	·224	5·7	G. E. Lloyd Baker ..	Hardwicke G.
Ditto	1·054	11—13	·27	·240	6·5	E. Clark	Tenbury W.
Ditto	1·045	8·75—10·75	·17	·170	2·8	J. Davies	Marden H.
SAM'S CRAB	1·044	8·5—10·5	·37	·098	5·8	Ditto ..	Ditto H.
SKYRMES KERNEL	—	—	·59	·198	—	A. Clark	Tewkesbury G.
SLACK MA GIRDLE	1·047	9·25—11·25	·28	·114	5·2	G. Ash	Newton St. Cyres D.
Ditto	1·042	8—10	·35	·126	5·8	J. W. F. Bickford ..	Barton D.
STYRE WILDING	1·050	10—12	·24	·210	7·5	E. G. Shew	Ledbury H.
SPREADING NORMAN ..	1·048	9·5 —11·5	·36	·472	8·2	Ditto	Ledbury H.
STEWART'S KERNEL ..	1·052	10·5 —12·5	·43	·216	5·8	Earl Beauchamp ..	Madresfield Court W.
STRAWBERRY NORMAN ..	1·043	8·25—10·25	·19	·240	5·7	E. G. Shew ..	Ledbury G.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
SWEET ALFORD..	1·051	10·25—12·25	·31	·164	8·5	A. E. Ellis ..	Newton St. Cyres D.
SWEET ALFORD..	1·050	10—12	·24	·132	4·3	G. Ash	Ditto D.
UNKNOWN	1·065	13·75—15·75	·46	·190	7·6	H. C. Hancock ..	Milverton S.
UNKNOWN	1·058	12—14	·21	·290	5·9	J. S. Smyth Osbourne	Ash D.
UNKNOWN	1·050	10—12	·42	·280	7·7	D. Powell	Newton Court M.
UNKNOWN	1·075	16·25—18·25	·27	·332	8·3	H. Winter	Axbridge S.
WHITE JERSEY	1·053	10·75—12·75	·15	·184	3·6	Col. Cary Batten ..	Keyford S.
WHITE NORMAN	1·056	11·5 —13·5	·28	·238	5·5	E. Clark	Tenbury W.
WOODBINE	1·050	10—12	·38	·162	8·7	G. Ash	Newton St. Cyres D.
YELLOW STYRE	1·059	12·25—14·25	·80	·102	3·3	Rev. Dowdeswell ..	Tewkesbury G.
PEARS—							
BUTT	1·047	9·25—11·25	·48	·104	5·0	W. Wallis	Dymock G.
HUFFCAP	1·053	10·75—12·75	·34	·160	6·2	H. J. Phelps ..	Tibberton G.
NEWTON COURT	1·045	8·75—10·75	·40	·066	9·5	D. Powell	Newton Court M.
MOORCROFT	1·063	13·25—15·25	·60	·070	3·7	G. E. Lloyd-Baker..	Hardwicke G.
OLDFIELD	1·046	9—11	·53	·076	6·2	R. H. Cazalet ..	Castlemorton W.
Ditto	1·059	12·25—14·25	·52	·178	2·8	W. Wallis	Dymock G.
Ditto	1·042	8—10	·43	·068	15·5	Cider Institute ..	Long Ashton S.
Ditto	1·038	7·0 — 9·0	·26	·128	7·0	Harper Adams Coll.	Newport, Shropshire
Ditto	1·047	9·25—11·25	·31	·058	6·2	H. J. Phelps ..	Tibberton G.
PINT	1·047	9·25—11·25	·72	·066	7·7	W. Wallis	Dymock G.
SPICE	1·047	9·25—11·25	·45	·170	5·3	R. H. Cazalet ..	Castlemorton W.
TAYNTON SQUASH	1·042	8—10	·13	·022	6·0	Harper Adams Coll.	Newport, Shropshire
THORN	1·042	8—10	·52	·060	4·3	W. Wallis	Dymock G.

INVESTIGATIONS ON BORDEAUX MIXTURES.

Reference was made in last year's Report to work carried out in collaboration with Mr. Gimingham with the object of throwing light upon the nature of the fungicidal action of Bordeaux Mixtures. During the past season this investigation has been continued, and a good deal of further evidence obtained in support of the view that Bordeaux Mixtures act as fungicides chiefly because the fungi are able to poison themselves by absorbing copper from any portions of the insoluble copper compound with which they may come into contact.

The action of Bordeaux Mixtures upon other types of cells in addition to germinating fungus spores has been studied. For example, seedlings of mustard and other plants were grown with their roots in contact with the insoluble Bordeaux precipitate and contrasted with others having their roots dipping into the clear liquid obtained by allowing Bordeaux Mixture to settle; in the latter case the delicate root hairs being in the same liquid as the insoluble Bordeaux precipitate, but not actually in contact with it. The result of these and similar experiments was to show that, so long as contact between the copper compound and the root-hairs was avoided, the seedlings grew in a healthy manner, but that the roots were shrivelled and killed when the Bordeaux precipitate was in close touch. The thin-walled cells of the root hairs evidently possess the power of absorbing copper and destroying themselves, just as do germinating fungus spores.

At the same time it is probable that such action as this on the part of the fungus is not the only one that takes place in practice when Bordeaux Mixture is sprayed on to leaves. Every fruit-grower is familiar with the scorching that so often follows spraying. This is probably due very largely to the action upon the interior tissues of the leaf of copper brought into solution by excretions from injured spots on the surface of the leaf; and experiments have shown that the amount of scorching largely depends upon the extent of the original injuries, whether naturally or artificially produced. Now since during most of the year it is a matter of the greatest difficulty to find leaves of fruit trees quite free from large or small injuries, a certain amount of copper will become soluble when Bordeaux Mixture is deposited on the leaves, and this soluble copper no doubt has fungicidal value. In this connection, it is, however, necessary to take into account the length of time since the production of the injury as it was found that only comparatively recent injuries affected the degree of scorching.

SOIL ANALYSES.

Mr. C. T. Gimingham has been engaged recently upon an examination of the soils in the various orchards and plantations at the Institute. He has provided the following preliminary report.

"In order to obtain a knowledge of any local variations which might be of importance in planning future experiments, a detailed investigation of the soils of the research station is being carried out. Samples representative of each of the fields—both of the surface soil (top 9 inches), and of the subsoil (second 9 inches)—have been

MECHANICAL ANALYSES OF THE SURFACE SOILS.

	1 Young Orchard.	2 Old Orchard.	3 Plantation No. 1	4 Plantation No. 2	5 Paradise Plantation.
Fine Gravel	0·73	0·70	0·82	0·94	1·04
Coarse Sand	19·36	10·85	10·55	9·61	11·04
Fine Sand	35·16	42·55	40·86	34·96	38·51
Silt	11·46	14·00	13·18	14·34	13·52
Fine Silt	16·50	15·20	18·82	21·21	18·46
Clay	5·1	6·67	7·16	10·16	9·25
Moisture	2·4	2·4	1·83	2·48	1·92
Organic Matter ..	8·18	7·31	5·53	5·61	5·35
Carbonate ($CaCO_3$)	0·43	0·02	0·07*	0·35	0·22
	99·32	99·7	98·82	99·66	99·31

Nos. 1 to 4 adjoin one another, whilst No. 5 is separated from the rest by the G.W.R. main line.

* Varies.

taken, and both chemical and mechanical analyses of the air-dried samples are included. For purposes of comparison, the mechanical analysis of soils, *i.e.*, the determination of the proportions of the various grades of particles, together with the amounts of organic matter and of lime (*calcium carbonate*) is of much greater value than the chemical analysis and the results of the former only are given here.

All the land attached to the station is situated on the New Red Sandstone formation (Keuper Marl), the surface soil consisting of a stiff reddish loam, very free from stones, which bakes to a hard crust in hot weather; the subsoil is much more clayey and in places is very stiff indeed.

The figures in the accompanying Table, which give the results of the mechanical analyses of the surface soils, show at once that all belong to the same general type. The soils from the various fields are indeed remarkably uniform. This is a very important point in connection with experimental work, for, only when the soil conditions are fairly uniform over a comparatively big area, is it possible to place reliance on the figures obtained from field trials.

There are, however, certain minor differences revealed by the figures which are of some interest. It will be noticed that No. 1 —the young orchard—contains a decidedly higher proportion of "coarse sand" and a lower proportion of "clay" (the finest particles) than the other soils, and it is evidently of a slightly lighter nature on the whole. On the other hand, No. 4—plantation No. 2—is the heaviest soil of the five, containing the lowest proportion of "coarse sand" and the highest proportion of "fine silt" and "clay." This, no doubt, accounts for the fact that the percentage of moisture is higher than in the other two arable soils, whilst the higher figures

MECHANICAL ANALYSES OF THE SUBSOILS.

	1. Young Orchard.	2. Old Orchard.	5. Paradise Plantation.
Fine Gravel ..	1·00	1·05	0·25
Coarse Sand ..	17·21	11·87	6·46
Fine Sand ..	39·44	45·18	31·84
Silt	11·97	16·75	13·35
Fine Silt ..	15·42	10·65	22·21
Clay	9·75	9·61	18·02
Moisture ..	1·44	1·40	2·02
Organic Matter ..	3·25	2·60	3·07
Calcium Carbonate	0·22	0·26	1·23
	99·70	99·37	98·45

for moisture in the orchard soils are due to the higher proportion of organic matter they contain.

The amount of lime (*calcium carbonate*) present varies a good deal: the original stock is evidently small and is almost exhausted in the old orchard, and the higher amounts in the plantation soils are due to dressings of lime applied from time to time. These latter figures can only be taken as approximately correct, since determinations of the amount present in samples from different parts of the fields varied considerably.

Table II. gives the analyses of the *subsoils* of three of the fields. These call for little comment. In the two orchards, there is no sensible change from soil to subsoil, except in the proportion of organic matter. In the Paradise plantation, however, the subsoil is very much more clayey than the surface soil, containing a considerably lower percentage of "coarse sand" and a much higher percentage of "fine silt" and "clay." It contains also more than 1% of chalk and differs essentially from the subsoils of the other fields.

WINTER SPRAYING EXPERIMENTS FOR THE SEASON 1912–13.

The winter spraying of fruit trees has come to be regarded as more or less essential in up-to-date fruit culture. Since the trees are at that season of the year in a dormant condition the spraying material used may be of a much more drastic character than any which can be applied with safety during the growing period. At the same time the pests themselves are for the most part in the egg or resting stage, and are consequently more resistant to the action of the spray fluid. The main objects of winter spraying therefore are two-fold: on the one hand, to clean the trees by killing or removing moss, lichen, and other harbouring places for the pests, and, on the other hand, to damage or otherwise weaken the pests by the direct action of a comparatively caustic fluid. Until recently the type of fluid most in favour has been a wash containing a strong caustic alkali, such as caustic soda, as the principal active constituent with the addition in some cases of paraffin or other penetrating organic substances. There is now a tendency to discard strongly caustic fluids of this type, since their effect on the tree itself in some instances appears to have been injurious. In their place variants of the old-fashioned lime wash are being tried. Lime alone is sometimes used. Others prefer lime and salt, or lime, sulphur, and salt. A comparatively modern innovation, the lime-sulphur wash, frequently used in a dilute form as a summer fluid for fungicidal purposes in the place of Bordeaux mixture, is now also commanding attention in a more concentrated condition for winter work. The accounts of the effect of the respective fluids are conflicting, good results being shown in some quarters and comparative failure in others. How far the variations should be attributed to different local conditions, or how far to lack of uniformity in the composition of the fluid or the method of making or application, is uncertain. It has, therefore been suggested that it would assist in arriving at definite conclusions as to the value of the respective fluids, if the Institute organised a series of trials at suitable centres in the West of England, each to be carried out under the immediate supervision of a member of the staff of the Institute to ensure uniformity both in the method of making of the fluid and also of its application. During the winter season 1912-3, such a scheme has been organised, the work being in the hands of Mr. A. H. Lees, who was appointed in November, 1912, to take charge of the work on diseases and pests

of plants. Attention has been directed in the trials thus far carried out almost exclusively to the various forms of lime washes. In their case efficiency is believed to depend mainly upon the thoroughness of the coating of lime applied to the trees and its adhesiveness, since being far less caustic in action than the typical caustic winter washes they rely for their effect mainly on the imprisonment of the pests until the young spring growths of the trees have developed beyond the critical stage.

The following report on the work as far as it has proceeded at present, has been furnished by Mr. Lees :—

One of the worst insect pests of apples is the apple sucker (*Psylla mali*). So far the standard winter remedy has been lime and salt applied hot, and as thick as possible to the trees just before the buds break. This spray fluid, though sticking fairly well, leaves a good deal to be desired in the direction of adhesiveness. The spraying must be done immediately before the buds burst, which takes place about the same time as the insect hatches. This necessitates a great deal of spraying in a short time where many apples are grown. Accordingly experiments were made to find some more adhesive wash.

Preliminary experiments were done indoors and consisted in coating apple twigs with the mixture to be tested. The following were tried :—

Lime alone, at the rate of 20 lbs. lime to 10 gallons of water.
Lime and salt, at the rate of 20 lbs. lime, 2 lbs. salt, 10 gallons water.
Lime and waterglass : 20lbs. lime, 1lb. waterglass, 10 gallons water.
Lime and cement at various strengths.
Lime and size.
Ground chalk and size, at various strengths.
Whiting and size, at various strengths.
Lime and tar, at various strengths.
Lime and pitch.
Lime and tar and pitch, at various strengths.
Lime and tallow, at various strengths.

Of these mixtures some were tried outside at various county centres in March. Lime sulphur was also tried at all the county trials as a fungicide. At the three Devon centres, *i.e.*, Mr. Lawrence, Cullompton ; Mr. Lambert, Spreyton ; Miss M. E. Divett, Riverside, Bovey ; the following washes were used :—

Lime and salt : 20lbs. lime, 2lbs. salt, 10 gallons water.
Lime sulphur (Voss') : 1 gallon, water 11 gallons.
Whiting and size : 80lbs. whiting, size 10lbs., water 10 gallons.

At the following places : Mr. Redman, Stoughton, Somerset ; Sexey's School, Blackford, Somerset ; Mr. Broomfield, East Tytherton, Wilts ; Mr, Gunrin, Hilperton Dairy, Wilts ; Right Hon. Lord Fitzhardinge, Berkeley, Glos. ; Sir Alfred Apperley, Rodborough, Glos. ; Mr. Richard Whiting, Credenhill, Herefordshire ; Messrs. Getting & Newton, Ross, Herefordshire ; the following washes were used :—

Lime-sulphur (Voss') : 1 gallon to 11 gallons water.
Lime and salt : 20lbs. lime, 2lbs. salt, 10 gallons water.
Lime and tallow : 60lbs. lime, 2lbs. tallow, 30 gallons water.

At the Institute the following washes were used :—

Lime alone, 20lbs. to 10 gallons water.
Lime and salt : 20lbs. lime, 2lbs. salt to 10 gallons water.
Lime and tallow : 60lbs. lime, 2lbs. tallow to 30 gallons water.
Copper sulphate, 5 per cent.
Lime-sulphur (Voss') : 1 gallon to 11 gallons water.
Home-made lime-sulphur.

These washes were repeated three times on different parts of the plantations and orchards, controls being always left. A couple of trees were also sprayed with lime and tar mixture, and lime and a mixture of tar and pitch, the quantities being :—

(*a*) lime 20lbs., tar 2½lbs., water 10 gallons ;
(*b*) lime 20lbs., tar 1¼lbs., pitch 1¼lbs., water 10 gallons.

It is too early as yet to give any definite results, but so far the whiting and size wash has proved itself far superior in sticking power to all the others. Unfortunately it is prohibitively expensive for large trees, but might be economically possible where it is desired to cover bushes thoroughly in private garden work. The size is the most expensive part, and it is probable that a cheap form of glue could be substituted. One of the greatest advantages of the whiting and size is that it does not burn at all, and so may be applied immediately before the apple sucker eggs hatch.

THE DATE OF BLOSSOMING OF VARIETIES OF APPLES, PEARS, PLUMS AND SMALL FRUITS.

The following table contains the records of the flowering periods of the various fruit trees and bushes grown in the plantations and orchards at the Institute. The records have been kept each year from 1908 onwards, and have been published annually in the Reports of the Institute. The dates recorded were taken when the first bloom of each variety was fully open, and not, as is the practice with some observers, when the trees were in full blossom. It does not appear to be a matter of much importance which system is adopted, since the object of the statistics is rather to furnish data to enable the varieties to be classified into early, mid-season, and late flowering groups, according to their period of blossoming, than to show the actual position of a tree in respect of the extent of the development of its blossom on a given date in a particular year. The facts already collected at the Institute and other places prove that varieties can be satisfactorily classified into such groups. Although the sequence of varieties is by no means constant year by year, it is quite abnormal for, say, an early flowering variety to blossom so far from its usual period in any given year as to cause it to rank with the mid-season or late varieties for that year, and *vice versa*. At the same time there are naturally certain border-line varieties about which there is room for doubt as to whether they should be considered early or mid-season kinds, or mid-season or late kinds, as the case may be.

Although, since the time or period of blossoming cannot be controlled by the fruit-grower, a knowledge of the flowering dates of individual varieties may be considered at first sight as a matter of interest rather than of importance, recent investigations have proved that the whole question is one which demands careful attention on the part of the grower. In the first place his selection of varieties to plant should be influenced by the nature of the site of the plantation. If, for example, it is liable to spring frosts, a variety belonging to the late blossoming class will be subject to less risk of frost damage than one belonging to the early or mid-season classes. In the second place, where the number of varieties of any kind of fruit is to be restricted to a very few, it is important that their blossoming periods should more or less synchronize. It is now known that apparently a large majority of varieties of most of the commoner

fruits are more or less self-sterile and that, if satisfactory crops are to be obtained from them, their blooms must be crossed with the pollen of another variety. Hence, when the number of varieties grown is limited to a few sorts, it is very necessary that their time of flowering should be approximately the same. Yet another point of importance in connection with blossoming dates has come to light within the last two years. There is evidence which indicates that the period of blossoming is apparently a Mendelian factor, and that accordingly early or late flowering varieties can be bred by suitable selection of the parents. In connection with the fruit breeding work which is being carried on at the Institute several apple seedlings have been raised, of which the variety Médaille d'Or is one of the parents. This variety may be fairly ranked as the latest blossoming apple in the Institute collection. Almost all of the seedlings referred to remain dormant in the spring appreciably longer than any of the other seedlings which have been raised from different parents. It therefore seems highly probable that lateness in bud bursting is dominant to earliness. This idea receives confirmation from a younger batch of seedlings raised from Médaille d'Or, the male parents in these cases being unknown. With these, again, the buds remain dormant in the spring after those of other seedlings, of the same age but of different parentage, have begun to open. Médaille d'Or itself is such a late bloomer that it can be regarded as practically free from any liability to frost damage during the flowering period. Hence by using this, or possibly other almost equally late sorts, such as Court Pendu Plât, as one of the parents in crosses it seems possible that new races of apples practically immune to frost damage may be raised at will. It remains to be seen whether plums and pears will behave in the same way. In their case there is even more to be gained by raising late blossoming varieties than with apples.

Variety.	Date of Flowering.				
	1912	1911	1910	1909	1908
APPLES.					
Market Varieties :—					
Lord Suffield	Apl. 13	May 8	Apl. 29	May 9	May 10
Siberian Crab	„ 15	„ 5	„ 24		
Stirling Castle	„ 15	„ 7	„ 29	„ 6	„ 5
Lane's Prince Albert	„ 15	„ 10	May 8	„ 11	„ 11
Bramley's Seedling	„ 19	„ 7	„ 10	„ 5	„ 1
Ecklinville	„ 19	„ 8	„ 4	„ 7	„ 11
Keswick Codlin	„ 19	„ 8	Apl. 29		
Beauty of Bath	„ 20	„ 5	May 4	„ 7	„ 6
Bismarck	„ 20	„ 4	„ 2	„ 7	
Devonshire Quarrenden	„ 20	„ 7	„ 1	„ 6	„ 5
James Grieve	„ 20	„ 6	„ 6	„ 5	„ 13
Lord Hindlip	„ 20	„ 6	„ 7	„ 8	
Warner's King	„ 20	„ 5	Apl. 30	„ 5	
White Transparent	„ 20	„ 5	May 2	„ 7	„ 11
King of the Pippins	„ 21	„ 8	„ 8	„ 6	„ 12
Peasgood's Nonsuch	„ 21	„ 8	„ 3	„ 10	
Allington Pippin	„ 22	„ 8	„ 12	„ 7	
Dartmouth Crab	„ 22	„ 8	„ 8		
Rival	„ 22	„ 10	„ 7	„ 11	
Sturmer Pippin	„ 22	„ 8	„ 4	„ 5	„ 9
Wealthy	„ 22	„ 8	„ 1	„ 9	„ 12
Worcester Pearmain	„ 22	„ 7	„ 4	„ 7	„ 11
King's Acre Pippin	„ 22	„ 9	„ 8	„ 7	
Charles Ross	„ 24	„ 8	„ 7	„ 7	
Frogmore Prolific	„ 24	„ 9	„ 8	„ 9	
Newton Wonder	„ 24	„ 8	„ 14	„ 9	
Wellington	„ 24	„ 14	„ 10		
The Queen	„ 24				
Coronation	„ 25	„ 15	„ 19	„ 14	
Houlbon	„ 25	„ 10	„ 13	„ 8	
Lord Grosvenor	„ 25	„ 9	„ 4	„ 9	
Lord Derby	„ 25	„ 10	„ 12	„ 10	
Potts' Seedling	„ 25	„ 9	„ 5	„ 10	
Gascoyne's Scarlet Seedling	„ 25		„ 12	„ 11	
Cox's Orange Pippin	„ 27	„ 9	„ 9	„ 9	May 11
Lady Sudeley	„ 28	„ 9	„ 18	„ 9	„ 14
American Mother	„ 29	„ 10	„ 21	„ 9	
Blenheim Orange	„ 29	„ 8	„ 12	„ 7	
Golden Noble	„ 29	„ 10	„ 17	„ 14	
Royal Jubilee	May 1	„ 14	„ 18	„ 14	„ 2[illegible]
Annie Elizabeth	„ 3				
Court Pendu Plât	„ 9	„ 15	„ 24	„ 14	

Variety.	Date of Flowering.				
	1912	1911	1910	1909	1908
APPLES (on the Paradise Stock).					
Vintage Varieties :—					
Rouge Bruyère	Apl 26				
Cap o' Liberty	„ 27	May 13		May 8	
M. Jacques	„ 27	„ 11	May 2	„ 8	May 11
The Bell	„ 27			„ 13	
Tardive Forestier	„ 28	„ 13		„ 8	
Victoria	„ 28	„ 11		„ 9	
White Norman	„ 28	„ 12		„ 13	
Bealy Down Pippin	„ 28			„ 8	
Hardwicke	„ 28			„ 9	
Cremière	„ 29	„ 10		„ 12	
Improved Pound	„ 29	„ 12		„ 10	
Knotted Kernel	„ 29	„ 12		„ 13	
Broadleaf Norman	„ 29			„ 13	
Ecarlatine	„ 29			„ 8	
Eggleton Styre	„ 29			„ 9	
Bramtot	„ 30	„ 10		„ 11	
Doux Amer	„ 30	„ 12		„ 10	
Footlands, No. 2	„ 30	„ 16		„ 11	
Kingston Black	„ 30	„ 17		„ 11	
Kingston Black Improved	„ 30	„ 12	„ 17	„ 11	
White Bache	„ 30	„ 12		„ 11	
Never Blight	„ 30			„ 11	
Pytheres	„ 30			„ 13	
Sweet Coppin	„ 30			„ 11	
Reinette Obry	May 1	„ 12		„ 9	
Fair Maid of Devon	„ 1			„ 10	
Porter's Perfection	„ 1				
Major	„ 2	„ 12	„ 20	„ 13	
M. Jacques, No. 2	„ 2			„ 13	
Maggs' Seedling	„ 3	„ 12		„ 9	
Wine Sour	„ 3				
Rouge de Trèves	„ 4	„ 12		„ 9	
Roux	„ 4	„ 12		„ 10	
Thomas Hunt	„ 4	„ 11	„ 17	„ 11	
Dove	„ 4		„ 23	„ 9	
Pride of Australia	„ 4			„ 8	
Taylor's Spie	„ 4			„ 12	
Cherry Pearmain	„ 5		„ 10	„ 9	
Smythe Osborne, No. 7	„ 5				
Dabinett	„ 6	„ 16	„ 15	„ 13	May 22
Sweet Alford	„ 6	„ 11	„ 13	„ 11	
Argile Grise	„ 6			„ 9	
M. Jacques, No. 1	„ 6			„ 8	
Royal Jersey	„ 7	„ 14	„ 22	„ 11	„ 6
Sandford Jersey	„ 7	„ 13		„ 13	

Variety.	Date of Flowering.				
	1912	1911	1910	1909	1908
APPLES (on the Free Stock).					
Vintage Varieties :—					
Ecarlatine	Apl. 18	May 10	May 9	May 12	
Fertile de Caen	„ 19				
Eggleton Styre	„ 21	„ 9	„ 5	„ 11	May 15
Jones' Seedling	„ 21	„ 9	„ 8	„ 10	„ 18
Butleigh, No. 14	„ 21				
Tardive Forestier	„ 21				
Stuart's Seedling	„ 22	„ 11	„ 9	„ 11	„ 26
Stubbard	„ 22				
Knotted Kernel	„ 23	„ 9	„ 5	„ 13	„ 16
Court Royal	„ 23	„ 8	„ 6	„ 11	„ 12
Cap o' Liberty	„ 23	„ 7	„ 9	„ 11	„ 14
Crémière	„ 24	„ 12	„ 12	„ 12	„ 21
Reinette Obry	„ 24	„ 13	„ 14	„ 17	„ 20
Rouge de Trèves	„ 24		„ 14	„ 22	„ 24
Maggs' Seedling	„ 25	„ 10		„ 11	„ 22
Sharpe's Midsummer	„ 25	„ 12	„ 9		„ 23
Bramtot	„ 25				
Rouge Bruyère	„ 26	„ 24	„ 14		
Cherry Pearmain	„ 28	„ 12	„ 11		
Royal Jersey (Butleigh)	„ 28	„ 21	„ 19	„ 22	„ 23
Early Cider Pearmain	„ 29				
Skyrme's Kernel	„ 30	„ 13	„ 15	„ 19	„ 22
Cherry Norman	„ 30	„ 16	„ 22	„ 20	„ 29
Oakham Green	„ 30				
Kingston Black	May 2	„ 12	„ 12	„ 13	„ 24
Chisel Jersey	„ 3	„ 9	„ 9	„ 11	„ 17
Neverblight	„ 3	„ 15	„ 18	„ 21	„ 25
Bédan-des-Partes	„ 4	„ 20	„ 17	„ 21	„ 31
Cowarne Red	„ 4	„ 13	„ 14	„ 17	„ 21
Royal Jersey	„ 4	„ 13	„ 19	„ 23	
Sweet Alford	„ 4	„ 12	„ 14	„ 19	„ 22
Black Norman	„ 4	„ 13	„ 14	„ 19	„ 8
Dymock Red	„ 4	„ 9	„ 9	„ 11	„ 24
Strawberry Norman	„ 4	„ 19	„ 21	„ 19	„ 8
Dabinett	„ 5	„ 12	„ 14	„ 17	„ 22
White Jersey	„ 5	„ 14	„ 17	„ 23	„ 25
Broadleaf Norman	„ 5	„ 13	„ 14	„ 17	„ 30
White Alphington	„ 5				
Broadleaf Jersey	„ 6	„ 17	„ 13	„ 14	„ 23
Doux Amer	„ 6	„ 12	„ 17	„ 12	„ 22
Harry Masters	„ 6	„ 17	„ 20	„ 22	„ 18
Sweet Coppin	„ 6				
Major	„ 7				
Sandford Jersey	„ 7				
Fréquin Audièvre	„ 12	„ 19	„ 23	„ 22	„ 29
Médaille d'Or	„ 30	„ 18	„ 10	„ 20	„ 31

Variety.	Date of Flowering.				
	1912	1911	1910	1909	1908
PEARS.					
Market Varieties :—					
Louise Bonne de Jersey ..	Mar. 25	Apl. 13	Apl. 3	Apl. 20	Apl. 22
Beurré d'Amanlis	„ 29	„ 21	„ 13	„ 28	May 1
Vicar of Winkfield	Apl. 1	„ 21	„ 13		
Durondeau	„ 1	„ 27	„ 24	„ 26	„ 1
Conference	„ 2	„ 20	„ 15	May 1	
Bellissime d'Hiver	„ 2	„ 29	„ 13	Apl. 26	„ 1
Doyenné Boussoch	„ 6	„ 22	„ 13	„ 24	Apl. 28
Petite Marguerite	„ 6	„ 25	„ 23	May 1	
Catillac	„ 8	„ 29	„ 22	„ 3	May 3
Williams' Bon Chrétien ..	„ 9	„ 21	„ 14	Apl. 28	Apl. 30
Beurré Hardy	„ 9				
Emile d'Heyst	„ 9	„ 19	„ 15	„ 28	„ 1
Hessle	„ 10	„ 29	„ 21	May 3	
Dr. Jules Guyot	„ 13	„ 26	„ 18	„ 3	May 3
Pitmaston Duchess	„ 13	„ 28	„ 21	„ 3	„ 3
Triomphe de Vienne	„ 13		„ 25	„ 4	
Vintage Varieties :—					
Moorcroft	Apl. 7	May 3	May 1	Apl. 30	May 3
Tayton Squash	„ 8	„ 4	Apl. 30	„ 30	„ 3
Oldfield	„ 13	„ 3	May 1	May 5	„ 3
Pine	„ 15	Apl. 24	„ 1		
Amphlett	„ 15				
Dandoc	„ 16				
Barland	„ 18	May 4	Apl. 30		
PLUMS.					
Mallard	Mar. 20	Apl. 3	Apl. 10	Apl. 17	Apl. 19
Jefferson	„ 22	„ 14		„ 17	
Monarch	„ 22	„ 14	„ 15	„ 17	„ 30
Late Orange	„ 23	„ 19	„ 25	„ 19	
Heron	„ 24	„ 17	„ 15	„ 18	„ 30
Denniston's Superb	„ 25	„ 19	„ 20	„ 22	„ 30
Early Transparent Gage ..	„ 26	„ 19	„ 20	„ 22	„ 30
President	„ 26	„ 20	„ 23	„ 28	May 1
Early Prolific	„ 27	„ 18	„ 20	„ 22	Apl. 29
Belle de Louvain	„ 28	„ 24		„ 26	
Victoria	„ 29	„ 19	„ 19	„ 22	May 1
Czar	„ 30	„ 21	„ 17	„ 23	Apl. 30
Pond's Seedling	„ 31	„ 23	„ 27	„ 26	
Goliath	„ 31	„ 25			
Kirke's	Apl. 3			„ 26	

Variety.	Date of Flowering.			
	1912	1911	1910	1909
RASPBERRIES.				
Abundance	May 1	May 25	May 25	May 28
Lord Beaconsfield	,, 4	,, 26	,, 25	,, 26
Superlative	,, 4			
Semper Fidelis	,, 5	,, 27	,, 25	,, 28
Northumberland Fillbasket	,, 5			
Red Antwerp	,, 7	,, 24	,, 25	,, 28
Carter's Prolific	,, 9	,, 31		,, 27
Norwich Wonder	,, 9			
Baumforth's Seedling	,, 11	,, 26	,, 24	
Hornet	,, 12			
STRAWBERRIES.				
Sir Charles Napier	Apl. 22	May 10	May 13	May 11
Leader	,, 22	,, 10	,, 10	,, 14
Profit	,, 27			
The Bedford	,, 27			
New Pineapple	,, 27			
Louis Gauthier	,, 28	,, 11	,, 18	,, 9
Auguste Nicaise	,, 28	,, 11	,, 9	,, 11
Scarlet Queen	,, 28	,, 10	,, 16	,, 13
Reward	,, 28			,, 13
Connoiseur	,, 28			
Cropper	,, 28			
Progress	,, 29			
Royal Sovereign	,, 30	,, 9	,, 14	,, 12
St. Antoine de Padoue	May 3	,, 11	,, 9	,, 12
Queen Denmark	,, 3	,, 12	,, 16	,, 14
Dr. Hogg	,, 4	,, 16	,, 15	,, 14
La Grosse Sucrèe	,, 5		,, 9	,, 11
Keen's Seedling	,, 5	,, 11	,, 9	,, 11
St. Joseph	,, 5	,, 12	,, 13	,, 11
Sir Joseph Paxton	,, 5			,, 17
Trafalgar	,, 5	,, 17	,, 20	,, 17
British Queen	,, 5	,, 17	,, 16	,, 17
Fillbasket (Laxton's)	,, 5	,, 15		,, 21
Elton Pine	,, 6	,, 16		,, 23
President	,, 7	,, 18	,, 23	,, 20
		,, 10	,, 19	
BLACK CURRANTS.				
Black Prince	Apl. 20	Apl. 26	Apl. 24	Apl. 27
Boskoop Giant	,, 20	,, 27	,, 27	,, 30
Victoria	,, 20	,, 26	,, 28	,, 29
Goliath	,, 22	,, 24	,, 24	,, 29
Ogden's Black	,, 22	,, 30	,, 24	,, 30

Variety.	Date of Flowering.	
	1912	1911
GOOSEBERRIES.		
Langley Gage	Mar. 21	Mar. 27
Keepsake	,, 22	,, 27
King of Trumps	,, 22	,, 30
Whinham's Industry ..	,, 22	Apl. 2
Crown Bob	,, 22	,, 2
May Duke	,, 22	,, 2
Mount Pleasant	,, 22	,, 2
Red Warrington	,, 22	,, 10
Golden Gem	,, 23	,, 15
Red Champagne	,, 24	,, 15
High Sheriff	,, 25	,, 8
Telegraph	,, 25	,, 8
Early Sulphur	,, 25	,, 10
Gretna Green	,, 25	,, 12
Lancashire Lad	,, 25	,, 13
Blucher	,, 25	,, 14
Surprise	,, 25	,, 21
Faithful	,, 26	,, 15
Falstaff	,, 26	,, 15
Ringer	,, 26	,, 19
Victoria	,, 27	,, 14
Hero of the Nile	,, 27	,, 17
Fascination	,, 27	,, 17
Careless	,, 28	,, 14
Diadem	,, 29	,, 16
Dan's Mistake	,, 30	,, 17
Leader	,, 30	,, 20
Transparent	Apl. 5	,, 18
Leveller	,, 6	,, 16
Thatcher	,, 6	,, 18
WHITE CURRANTS.		
German White	Mar. 27	Apl. 24
White Dutch	Apl. 1	,, 22
White Dutch Cut-leaved ..	,, 1	,, 25
White Transparent	,, 6	,, 22
White Versailles	,, 27	,, 27

Variety.	Date of Flowering.	
	1912	1911
RED CURRANTS.		
Fay's Prolific	Mar. 21	Apl. 22
Cherry	„ 27	„ 23
Comet	„ 27	„ 24
La Transparent	„ 27	„ 27
Knight's Sweet Red	„ 28	„ 23
La Fertile	„ 28	„ 24
La Versailles	„ 28	„ 23
Wilder	„ 28	„ 22
Red Cross	Apl. 1	May 1
La Hative	„ 2	Apl. 29
Wentworth Leviathan ..	„ 5	May 2
Moore's Seedling	„ 5	
Red Grape	„ 11	
Red American	„ 13	
New Red Dutch	„ 17	„ 1
Raby Castle	„ 17	„ 7

RETURNS FROM VARIETY TRIALS OF APPLES, PEARS, PLUMS, AND SMALL FRUITS IN PLANTATIONS I. AND II.

Name of Variety.		Yield in lbs. 1912.	Yield in lbs. 1906-11.
PLANTATION No. I.			
APPLES DESSERT—			
Allington Pippin	27 bushes and 3 standards ..	73½	716½
Beauty of Bath ..	„	—	57¾
Cox's Orange Pippin	„	1¾	315¼
Devonshire Quarrenden	„	127	93¾
King of the Pippins	„	45½	698¼
Worcester Pearmain	„	95	287½
CULINARY—			
Stirling Castle ..	„	13¼	384
Newton Wonder ..	„	159½	328¾
Lane's Prince Albert	„	20½	515¾
Bramley's Seedling	„	200¾	205½
Lord Suffield ..	„	86¼	85¼
Ecklinville ..	„	169½	359
PEARS—			
Catillac	„	314	10½
Doyenné Boussoch ..	„	269	91¾
Louise Bonne de Jersey	„	15¾	215¾
Williams' Bon Chrêtien	„	168¼	51½
GOOSEBERRIES—			
Crown Bob	90 plants	27½	1029¼
Keepsake ..	„	438½	2029¼
Lancashire Lad ..	„	181½	1441½
Whinham's Industry	„	400	2445½
RED CURRANTS—			
Fay's Prolific ..	90 plants	78½	716¼
Knight's Sweet Red	„	71¼	672½
Raby Castle ..	„	203¼	1208¼
WHITE CURRANTS—			
White Dutch ..	90 plants	14	976½

Name of Variety.	Yield in lbs. 1912.	1907-11.
PLANTATION No. II.		
APPLES—		
Bismarck .. 7 bushes and 3 standards ..	96¼	316
American Mother .. „	6¼	18½
King's Acre Pippin .. „	17	156¼
Lady Sudeley .. „	22	20¼
Lord Grosvenor .. „	—	269½
Warner's King .. „	115¾	190¼
White Transparent .. „	61	69¾
Gascoyne's Scarlet Seedling „	120	17¼
Court Pendu Plât 10 bushes	39½	40¾
Frogmore Prolific .. „	6¾	201
James Grieve .. „	122¼	202¼
Lord Derby .. „	60½	254½
Peasgood's Nonsuch .. „	81¾	17
Potts' Seedling .. „	—	164¾
Rival .. .. „	50¾	101¾
Sturmer Pippin .. „	37¾	214
Wealthy .. .. „	43¾	31½
Coronation .. .. „	8¼	40½
Golden Noble .. „	2	20
Lord Hindlip .. „	12½	21¾
Royal Jubilee .. „	141¾	11¼
Charles Ross .. „	29½	53¾
Wellington .. „	121½	82¼
The Houblon .. „	4¾	30¼
PEARS—		
Conference .. 7 bushes and 3 standards ..	138¼	31
Dr. Jules Guyot .. „	112¾	42½
Hessle .. .. „	95	28½
Pitmaston Duchess .. „	41	5½
Bellissime d'Hiver 10 bushes	87½	7½
Durondeau .. .. „	—	3
Emile d'Heyst .. „	35	30½
Vicar of Winkfield .. „	17½	½
Petite Marguerite .. „	44½	½
Beurré Hardy .. „	6	nil
Beurré d'Amanlis .. „	25¾	nil
Triomphe de Vienne „	5	nil
PLUMS—		
Denniston's Superb 7 bushes and 3 standards ..	—	18
Pond's Seedling .. „	62¼	117
Early Transparent Gage „	16½	49¾

Name of Variety.		Yield in lbs. 1912.	Yield in lbs. 1907-11.
PLANTATION No. II.—*continued.*			
PLUMS—*continued.*			
Belle de Louvain	7 bushels and 3 standards	1¾	26¾
Monarch	10 bushes	—	7½
Heron	„	—	17¾
Early Rivers	„	14	16
Czar	„	—	3¼
Mallard	„	—	6½
Late Orange	„	—	12
Victoria	„	7¾	50½
BLACK CURRANTS—			
Boskoop Giant	30 plants	6¾	100
Black Prince	„	21¼	54
Goliath	„	5¼	51¾
Ogden's Black	„	77	110
Victoria	„	11½	56½
RED CURRANTS—			
Cherry	30 plants	12½	28¼
Comet	„	—	22½
La Fertile	„	4¾	27¾
La Hâtive	„	8¾	23¾
La Versailles	„	18¾	34¾
New Red Dutch	„	61	144¾
Red American	„	—	44¾
Red Grape	„	9	20¾
Moore's Seedling	„	—	15
La Transparent	„	—	54½
Red Cross	„	27½	—
WHITE CURRANTS—			
White Dutch Cut Leaf	30 plants	5	51¾
White Transparent	„	9	55¼
White Versailles	„	5	54½

Name of Variety.	Yield in lbs. 1912.	1907-11.
PLANTATION No. II.—*continued.*		
RASPBERRIES—		
Abundance 150 plants	79	239½
Baumforth's Seedling „	8	252
Carter's Prolific „	17¼	189¼
Red Antwerp „	47½	362¼
Semper Fidelis (*a*) „	77¾	313
„ „ (*b*) „	68	193¼
Lord Beaconsfield „	98½	345
GOOSEBERRIES—		
Blucher 20 bushes	20	48½
Careless „	50⅝	217½
Early Sulphur „	100	101¾
Faithful „	50	195¾
Falstaff „	77	136½
Fascination „	41½	222
King of Trumps „	124	396
Leader „	96	167
Leveller „	—	187¼
May Duke „	104½	167
Mount Pleasant „	5½	109
Red Warrington „	85	169
Surprise „	67	245
Telegraph „	125¾	296
Golden Gem 10 bushes	7	61½
Gretna Green „	68½	163¾
Dan's Mistake „	—	41½
Diadem „	43	144½
High Sheriff „	8¼	48
Hero of the Nile „	19	23¾
Langley Gage „	98	140
Ringer „	3¾	53½
Thatcher „	14	74¾
Victoria „	30½	108¼
Red Champagne „	35	71¼
Transparent „	5	113

REPORTS ON THE TRIAL CIDER AND PERRY ORCHARDS PLANTED 1908–11.

GLOUCESTER.—Mr. G. H. Hollingworth, County Instructor in Horticulture, reports as follows :—

The following remarks apply to trees planted in December, 1908.

Hardwicke.—Nothing could be more gratifying than the progress made by the majority of the trees in this orchard. After the first cutting back a year after planting little pruning, except the thinning out of superfluous shoots, has been done, and the trees are mostly furnished with well-balanced heads. Since they were planted the majority of the trees have been kept cultivated round to a distance of not more than 2 feet from the stems, and the following figures go to show what a beneficial effect this treatment has on the establishment of newly planted trees.

DATE OF PLANTING.	VARIETY.	Circumference of trees that has been cultivated round. Measurement taken 4ft. from the ground.	Circumference of grassed tree 4ft. from the ground.
December, 1908	Royal Wilding ..	$5\frac{1}{2}$ ins.	$3\frac{1}{2}$ ins.
,,	Medaille d'Or ..	$5\frac{1}{4}$ ins.	$3\frac{1}{2}$ ins.
,,	Strawberry Norman	5 ins.	$3\frac{3}{4}$ ins.
,,	Kingston Black.. ..	$5\frac{1}{4}$ ins.	$3\frac{1}{4}$ ins.
,,	Sweet Alford ..	$6\frac{1}{2}$ ins.	$4\frac{1}{4}$ ins.

The heads of the trees show an equally big contrast, the grassed trees being small in comparison to the rest. There are a few instances of canker in the orchard, but applications of Lysol have been effective in checking this trouble.

Berkeley.—Under similar treatment the trees in this orchard are doing equally well, and the progress made in four years is highly satisfactory. A similar experiment to that at Hardwicke has been carried out and though it is easy to discriminate the trees the roots of which have been grassed over since they were planted, as they are not so big as the rest, nevertheless a number of the grassed trees have improved in the past year and are now developing into good specimens. It will be interesting to see the difference between the grassed trees and those that have been cultivated round in a few years' time, but the obvious advantage of cultivation is that it enables the trees to make a quick start into growth after planting. This is a highly important point where standard trees in grass orchards are concerned.

Lydney.—For the past year or so the grass in this orchard has been allowed to grow over the roots, but the effect of earlier cultivation for 2 feet from the stems has evidently left its mark for the trees, with a few exceptions, are making good progress. It is interesting to note that Cowarne Red, a rather fastidious variety, which has fallen a victim to canker in another orchard at Tibberton, is doing well here, and this goes to show the effect of soil influence as regards this trouble.

The following orchards were planted in January and February, 1910.

Dymock.—This orchard is devoted to perry pears, and with two exceptions the varieties are doing remarkably well under the treatment of cultivating round the stems. The exceptions referred to are Moorcroft, which has a stunted appearance, and has made little growth, and the Barland. At planting time the trees of this variety were bigger than any others, and now the stems are very strong, but the stocks below the point of union seem hard and bound, and they are not swelling in proportion to the stems above. Suckers are thrown up freely from the stems just above the ground, and in many places the bark on the branches is not clean and healthy. I am inclined to think that the seat of the trouble is in the stock, but up to the present these trees, which were the biggest at the time of planting, are the least satisfactory.

Tibberton.—As I have previously reported, Cowarne Red failed here on account of canker, and an attempt is being made to re-establish the variety by head-grafting it on strong growing sorts, but it is too early yet to report results. Though they had to pass through an exceptionally dry summer soon after they were planted, which had some effect on the strength of the growth that followed the first pruning, the trees with the exception of the variety named, have made satisfactory progress.

Speaking as a whole the orchards are serving a useful purpose as object lessons in the county, and their value in this respect should increase as time goes on.

Monmouth.—The following report, prepared by Mr. W. J. Grant, Director of Agricultural Education, has been passed by the Monmouthshire Education Committee :—The cider orchards, with few exceptions, are in a very satisfactory condition, although in some instances, where the fastenings have become broken or the wire protection has become loose and not received prompt attention, some of the trees were slightly damaged : but on the whole the young

trees are making satisfactory progress where odd trees have not been badly attacked with Aphis that could not be checked before the mischief had been done. The Perry orchards are not in quite as satisfactory a condition, the young Barland pear trees having suffered considerably from the weather—more than any of the other varieties planted. In some instances American blight again found its way to the young cider apple trees, but this pest was dealt with as soon as it appeared.

Devon.—Mr. C. Berry, County Instructor in Horticulture, has supplied the following report:—

Killerton House Orchard, 1913.—The trees are thriving. I pruned most of them in March. Improved Pound trees had made large growths. This sort is very irregular in habit. From one tree I cut fifty lengths averaging about eighteen inches, or one hundred and fifty feet total growth during 1912. Black Foxwhelp was upright in growth and healthy: some very fine trees. Médaille d'Or is also upright habit and doing well. Deux Amère trees are spurred full length with fruit-buds. Yarlington Mill is fairly fruitful. Cap of Liberty trees are full of fruit-buds. Owing to the plough trace tearing away the wire netting from the finest tree in the orchard, the rabbits have eaten the bark almost round the stem. A fine branch has been torn from one tree by, I presume, the collar of the horse while passing it. Other trees are satisfactory.

General Holley's Orchard, Okehampton (one mile and a half from station, L. & S.W.R.).—Cherry Norman does not do so well as others: canker attacks. Red Streak is doing well. Cowarne Red is doing well. Broad-leaf Norman thrives. Knotted Kernel grows on ploughed land and has done better than those trees on grass hoed; but this row has had a bank-protection.

Kingsnympton (three miles from South Molton Road Station, L. & S.W.R., North Devon).—Here are forty-nine trees, most of them are doing well. Chisel Jersey has shown some signs of canker, but trees sent down this year to replace the diseased ones have been planted. Skyrme's Kernel and Broadleaf Norman are doing well. Cherry Pearmain and Sweet Coppin also do well here.

Branscombe, East Devon (about four miles from Seaton Station L. & S.W.R.).—The trees are not so strong on this soil as at other places, but there is an improvement in growth over 1911.

Lower Washbourne, Harbertonford (five miles from Totnes). This orchard has passed into the possession of a new owner, who has allowed the trees to be destroyed.

Hereford.—Mr. A. J. Manning, County Instructor in Horticulture, reports as follows:—The orchard at Burghill continues making good progress. With the exception of Cowarne Red all the varieties are doing remarkably well: every variety fruited during the past summer and made from 18 inches to 20 inches of well ripened wood. They are all well furnished with bud again this year, and if the fulfilment is equal to the promise we shall have sufficient of each variety for the juice to be tested. The variety, Butleigh No. 14, promises to be a most useful one with us, as it grows well, and fruits freely, and I should think will prove a first class kind for blending.

Somerset.—Mr. John Ettle, County Instructor in Horticulture, has furnished the following report:—The trees in the three "County" orchards, have, with a few exceptions, done very well. The two varieties which have done badly are Kingston Black and Cowarne Red. These, I believe, are not doing well generally in some of the other counties. I am hoping to try an experiment in the near future of head grafting these two on some strong growing variety after the "Somerset" system, as against stem grafting or budding on what we have called the Hereford system. But it must be found in this, as in other kinds of experimental work, that all plants, flowers, or fruits, will not do equally well in various soils and climates: and, although it may take a good many years to carry it through, we hope to be able to prove to growers what are useless kinds for their soil, which to a certain extent will do as much good as showing them the most useful kinds.

Taking them alphabetically, the orchards at Barton St. David, Clutton, and Shepton Mallet are on different soils and at different altitudes, as mentioned in previous reports. The most pleasant and rather surprising thing to note in each orchard is how well the perry pears are growing. Surprising, because I have not been able to find a single old perry orchard in Somerset! In each case they are beating the apples as regards growth and early cropping qualities. It is also surprising that we can find no old perry orchards here, when we know how many have been planted in the neighbouring counties.

One difficulty we have found is to keep the trees well looked after, particularly as regards tying to keep in position. The County Instructors who are in charge of the orchard cannot be in two places at once. Trees get broken and those in local charge may not be on the look-out to notice it; and the bark of the trees then gets bruised in such a way that sometimes they will not heal over for years.

As regards pruning we have had very little trouble, as we have given this into the hands of the sons of the tenants, where we could and made them responsible, and, eventually give them the credit.

Other things, such as spraying, are difficult to arrange, for several reasons. Firstly, at least two are required, one in the winter for cleansing and putting on the tree a wash which will prevent the progeny from various eggs piercing the bark or other portions of the tree. Secondly, just as buds are bursting, to check the working of caterpillars, aphides, etc.; and, thirdly, when fruit is just forming, to prevent attacks of codlin moth, fusicladium, etc. Then a good sprayer is expensive, although for several years a knapsack would do, costing from about 36s. to 42s. But one man naturally thinks twice before spending even this, because he says that probably, if he is getting on in years, he may not see any adequate return. That is why we wish to impress on the younger men the importance of the work.

Mr. E. G. F. Walker, of Chew Stoke, reports that the pear trees supplied to him are all doing well. He has found that pruning the second year is better than the first for good growth.

Worcester.—The following reports have been collected by Mr. A. Weston Priestley, Director of Education :—

Newnham Court, Tenbury.—Mr. E. V. V. Wheeler reports :- All the trees are alive and making fair growth. None have borne fruit, yet, except the Medaille d'Or, from which there were a few baskets of fruit last year.

Powick.—Mr. G. Braine Hartnell writes as follows :—I beg to report that the trees sent by the National Fruit and Cider Institute are in good condition, and have been pruned quite recently.

Woollas Hill, Pershore.—Mr. J. William Dee reports :—The trees which I had from the National Fruit and Cider Institute continue to do remarkably well. Many of the trees had fruit on them last season; every one grew.

Suckley.—Mr. J. H. W. Best writes :—The cider apple trees supplied by the National Fruit and Cider Institute are growing satisfactorily.

Madresfield.—Mr. Wm. Crump reports as follows :—The thirty cider apple trees and twelve perry pear trees received from the National Cider Institute, Bristol, on November 27th, 1908, were carefully planted on grass land at Hayswood Farm, Madresfield, alongside of 474 other best sorts of apples and plums—thus forming a new orchard containing 524 trees, raised in our home nursery.

The trees have received proper and judicious attention in planting, pruning, staking, fencing and mulching. The whole of them have done well and made clean healthy growth, and altogether most promising in appearance, with prospect of well developed blossom. We shall be pleased to show the trees to any of the County experts or other practical fruit growers.

The above is a fair sample and description of several other orchards now being developed in the Madresfield Estates.

Staunton.—Mr. J. G. Hawkins writes :—It gives me much pleasure to be able to report that all these trees are growing well.

Beauchamp Court.—Mr. W. H. Gabb reports :—The perry pear trees which I had from the National Fruit and Cider Institute were planted in old turf and are doing well. It is of course too early to tell which sorts will be likely to succeed best in our locality.

Upton-on-Severn.—Mr. William S. Lane sends the following report :—There is little further to report this year on the orchard planted with trees from the National Fruit and Cider Institute. Except one tree, which I fear I shall lose, all the trees are growing well. They are very healthy, and as a result of this season's pruning the heads are strong and well shaped. The orchard has every appearance of coming into bearing in a few years.

Moor, Pershore.—Mr. T. W. Oldham reports :—The pears are all alive and look very well, but two summers ago when it was so dry, eight of the apple trees died; the remainder are all right.

Aspall Hall, Suffolk.—Mr. J. B. Chevallier's report is as follows :—Some of the trees are now getting nice heads. There was no crop in 1912, but only a few apples and pears here and there. In February, 1912, lime and sulphur was sprayed, and in April Herrod's Aphis Wash. The orchard looks healthy and vigorous for 1913.

Woolston, Somerset.—Mr. C. Osborn writes :—The apple and perry pear trees supplied us from the Institute are all making excellent progress, not one having failed. We should like also to testify to the thorough utility of the cheap one-post and wire fencing for standard trees, which we first saw at the Institute years ago and adopted at once in all our orchards with complete success.

Brembridge, Wilts.—Mr. L. H. Marshall reports as follows :—I have inspected the cider apple trees that were planted in Brembridge Farm, and find that five or six died soon after planting, six or seven of the others nearly dead, and the remainder with the exception of four have made no growth and are badly cankered. The four best trees were on deeper soil and only slightly cankered.

These trees, however, were badly damaged recently by a goat getting into the orchard and stripping the bark off them. The conclusion I arrive at is that the soil is too stony for fruit trees, and that they have not been looked after as well as they should have been.

Harper-Adams College, Newport, Shropshire.—Mr. G. T. Malthouse has supplied the following report :—The trees have continued to make good growth and all varieties cropped in 1912, but the yield of apples was below that from the pears. The undercrops, consisting of lucerne, sainfoin, red clover, linseed, maize and potatoes have not checked top growth as turf does, and there is no variation in growth of varieties with the different undercrops. The following weights of fruit were sent to the National Fruit and Cider Institute : Apples : Neverblight, 25lbs., Médaille d'Or, 60lbs. ; Cremiere, 52lbs. Pears : Oldfield, 87lbs. : Taynton Squash, 21lbs. Other varieties produced small crops. Insect and fungoid pests did practically no harm. On Cremiere there was a slight attack of Aphis, and two trees of Taynton Squash suffered from Fusicladium. Winter spraying has been specially directed against these pests.

Loders, Dorset.—The report of Mr. E. C. Parslow, County Instructor in Horticulture, is as follows :—Most of the trees (planted late in March, 1909), are well established and making very satisfactory progress. The exceptions are Foxwhelp and Virgin Mary. The former does not succeed at all on this soil. The failure of this variety is apparently due to stock influence, and the stems have throughout borne the appearance characteristic of unsuitable stocks. These trees have now been removed and replaced with others from the Institute during the winter, and these trees are much more promising than those supplied at the end of the planting season in 1909.

Virgin Mary and Broadleaf Norman appear very liable to canker, and the disease has necessitated the entire removal of one or two trees and of several well-placed branches on other trees. At the same time, the remedies employed (H. Emulsion for the wounds, and Lime at the roots) give promise of holding the disease in check.

The trees are not now being cut back, except the weaker growers such as Eggleton Styre ; and, although there is a very fair spur formation, the trees will not be allowed to carry more than a few fruit again this season.

Butleigh, Somerset.—Mr. R. Neville-Grenville sends the following report :—Apple trees from the Fruit and Cider Institute at Long Ashton, planted at Butleigh in November, 1908, 50 in

number, of which only two have died. The trees have been carefully tended, and the surface kept loosened for about a 4 ft. radius. None have made satisfactory growth, which they should have done in four years. They appear to be quite clean and healthy and almost without exception full of fruit buds, which seems to indicate that the trees would have been more successful in this soil in bush form. Probably in some soils they would have made the wood growth desirable in standard trees. Compared with standard trees raised here, which have been grafted on strong-growing varieties, (chiefly Morgan Sweet), the difference is most marked, both in diameter of the stem and growth and spread of branches. I should advise you to go in for this manner of producing apple trees which from long experience is the one universally adopted in this district.

Frampton Cotterell, Gloucester.—Mr. J. P. Eley writes as follows:—I beg to report that the cider apple trees which were planted here through the National Cider Institute are making satisfactory progress. The necessary pruning has been done, and I am pleased to say that in the majority of cases very good heads are being formed. Good average growth was made last summer, which was no doubt stimulated by plenty of moisture.

Sherborne, Dorset.—Messrs. Rawlence & Squarey report as follows:—We are sorry that we cannot report favourably on the trees. As we informed you in our last, several of them were damaged by the tenant's goat, and the others are not making good progress. The trees are planted close to the River Yeo, and we fear that the frosts and fog which seem to hang in the valley are not congenial to them.